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FEBRUARY 1946

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The Only Source of Higher Wages Is Greater Output . . . . page 82

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THE FAILURE OF "FACT-FINDING"

THE PRESIDENT has asked Congress to grant him authority to appoint fact-finding boards to deal with nationally important labor disputes. Most citizens would like to see some reasonable and objective solution of the industrial strife that now is disrupting reconversion. Unfortunately, the record of the "fact-finding" procedure indicates that any claim of impartiality for this process is a gross misrepresentation.

The Administration bill would authorize the President to appoint such boards in cases certified to him by the Secretary of Labor. Each board would report to the President "its findings of fact and such recommendations concerning the dispute as the board deems appropriate." Its facilities and staff would be provided by the Secretary of Labor. The bill provides for an interval of not more than 30 days known as a waiting or "cooling off" period during which it would be "unlawful" (though no penalties are specified) for anyone to promote or encourage work stoppages.

Because the Administration did not wait for Congressional action upon its proposal, but appointed a number of fact-finding bodies to deal with current emergency cases, we have been afforded at least a partial preview of how the procedure may be expected to work out if laws establishing it are passed.

If the reports handed down by the fact-finding panels in the General Motors and oil disputes may be regarded as representative, it can be stated conclusively that Government-appointed "fact-finding" boards will concern themselves to only a minor degree with the establishing of facts. A far greater share of their effort will be concerned with the speculative business of forecasting future output and production efficiency and appraising the "ability to pay" of the companies involved. But the predominant emphasis will be placed upon framing recommendations for settling the disputes in line with announced Government wage-price policy.

In short, the procedure essentially will be one of registering with the public a government opinion as to how far wages may be raised in the cases at issue without raising price ceilings. Both the General Motors and the Oil Panels stated, in quite explicit terms, that this was their conception of the job assigned them.

"Fact-Finding" in Auto and Oil Disputes

As the General Motors Panel phrased it: "This board subscribes to, and has been guided by, the national wage-price policy" – which it summarizes as calling for wage increases to maintain take-home pay at wartime levels, to the degree possible without inflationary price rises.

The Oil Panel was even more forthright in the statement of what it was supposed to do. "In the judgment of the panel," it declared, "the earnings of the workers must be as high as is consistent with both the maintenance of the stability of the price structure and the provision for reasonable returns to the owners of industry." In other words, prices and the return to investors are to remain fixed, with labor entitled to an ever-increasing return up to the limit of what the traffic will bear.

Having thus outlined their respective conceptions of the job, each panel proceeded to carry out its mission.

The Automobile Panel recommended that General Motors increase its basic hourly wage rates by 19½ cents, which amounts to about a 17½ per cent increase on the company's average hourly wage of $1.12. The Oil Panel recommended an 18 per cent increase in basic hourly wage rates, or an additional 21 cents to the average wage rate of $1.20.

The General Motors recommendation was based almost exclusively upon the Panel's calculation that a 19½ cent raise would keep weekly take-home pay equal to that earned in 1944 when the work-week averaged 45.6 hours. The calculation turned on an estimate of what the effective work-week was likely to be in 1946.

The Oil Panel's recommendation appears to have been based on a more complex but no more conclusive accounting. After calculating that the maintenance of July 1945 take-home pay after 40-hour shifts were restored would require a 22 per cent increase in straight-time hourly wages, it recommended that an 18 per cent increase be made. It accounted for 9½ per cent of this by noting that this was needed to cover cost-of-living rises, and explained that the rest was justified by a combination of factors including loss of premium overtime pay, higher productivity, and settlements already negotiated. Since the Panel gave no indication of the weight given to these several factors, it may not be unfair to assume that the last-named was given preponderant importance, since 18 per cent was the increase already granted in collective bargaining by Sinclair and certain other oil companies.

Higher Pay Without Higher Prices

Both panels stated that the pay increases recommended could be met without raising price ceilings, but neither documents its case on this score with very conclusive "facts".

The Oil Panel confined its observations on this account to the statements that only one company in its group had pleaded "inability to pay" and that the industry was in a generally profitable position during 1943 and 1944.

The Automotive Panel stated that, under a number of assumptions about the 1946 operations of General Motors which it believed to be valid, the Company would have higher earnings than it had in 1941, its previous record year. It specifically stated that its findings in the case were not applicable outside the

automobile industry, but it recognized that the General Motors settlement would more or less determine the settlements of other automotive companies. It stated that it had not been able to arrive at a clear conviction as to the ability of other auto makers to pay similar wage advances, but it dismissed the issue by observing that they could expect to operate at full capacity in 1946, and that this should provide savings to offset the increased wage expenditures.

From the management point of view, one of the most serious limitations in the panels' procedure was their failure to deal with any of the Company claims put forward. In ordinary collective bargaining the demands of both sides are advanced and concessions in one direction are traded for concessions in the other. Here, although the companies involved had insisted upon their need for guarantees against contract violations and wild-cat strikes, and for other union concessions, nothing but the wage issue was considered by the "fact-finding" bodies. The General Motors Panel specifically recommended that the wage increase of 19½ cents be granted, but that otherwise "the status quo prevailing before the strike be restored by the reinstatement of the 1945 contract between the parties." Handled thus, fact-finding becomes indeed a wholly one-sided exercise.

Both panels accepted, quite uncritically, the general position taken by Government spokesmen that wage increases are inflationary only if they are directly translated into price advances. It should be obvious that all wage increases add to the inflationary pressure, if made at a time like the present when consumer purchasing power far outstrips the volume of goods and services available to satisfy it.

"Fact-Finding" Dodged in Steel and Rails

It is ironic, too, that even while the Automotive and Oil Panel groups were holding the "government policy" line, the President and his Reconversion and Stabilization Directors were busily at work trying to dent it. In the steel dispute, although price rises in this industry have a particularly sharp inter-industry impact, hearings by the appointed fact-finding board were deferred while negotiations were carried forward by the President and his advisors under which the industry was offered a price increase of approximately $4.00 a ton on condition that U. S. Steel and the United Steelworkers agree upon a mutually acceptable wage boost. It is hard to avoid the cynical conclusion that wage increases constitute the major administration policy, and that the principle of not translating them into increased prices is sacred only in those cases where there can be some reasonably plausible showing that wages may be raised without price advances.

Much the same general conclusion — that the "facts" are controlling only if they support a substantial wage increase — is sustained by the history of the administration of the Railway Labor Act of 1926, often cited as a glowing example of how "fact-finding" by so-called Emergency Boards of Presidential appointees has served to prevent strikes on the railroads. It is true that reports of almost all of the 31 Emergency Boards appointed to look into threatened railway strikes in the 20 years since the act was passed have provided the basis for a settlement of the disputes in question. The fact — a real fact — remains, that in 1941 and again two years later the wage adjustments found appropriate by Emergency Boards in major railway labor disputes were revised upwards at the White House after the unions involved rejected them as unsatisfactory and threatened to strike. The second upward revision was made after government seizure of the railroads to prevent a national transportation tie-up. When the "facts" did not indicate a large enough wage increase to satisfy the union and the Administration, the "facts" went out the window.

It would be irresponsible to deny the importance of finding some tenable solution of current disputes that threaten to completely disrupt the reconversion process. But upon the evidence of experience, "fact-finding" boards cannot be expected to operate according to the common conception of their function — as agencies designed to sift out for the public an objective and significant weighing of the facts behind conflicting claims.

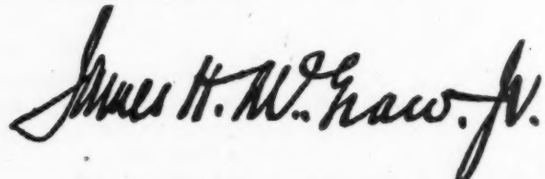
Without Principles Facts Mean Little

Facts, if they are assembled upon a sufficiently partisan basis, can be made to document almost any case one wishes to establish. The major difficulty in marshalling facts to resolve wage disputes is that there are no agreed-upon principles to determine the levels at which wages should be set. In the absence of such principles, it is inevitable that "fact-finding" boards, appointed by the Administration, manned largely by those who helped develop and administer Administration wage policies, and depending for technical assistance upon Administration Departments, will serve merely to implement Administration wage policy.

If Government means to reassert its wartime authority to fix wages — an objective specifically disavowed by the President and seemingly wanted by no one — it should accept the responsibility directly, rather than operate to that end through "fact-finding" boards which are independent in theory, but which cannot be so in fact.

The failure of the brand of "fact-finding" now urged upon Congress by the President is evident. Therefore, we must look for a solution along other lines.

What is needed is for labor and management to agree upon the principles that should govern the determination of wages under free collective bargaining. When such agreement is reached, then and only then, can fact-finding become an objective and useful instrument for settling wage disputes.



President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 44TH OF A SERIES

FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

Wages and Ability to Pay

Ability to pay is not a yardstick by which wage rates should be determined. Labor leaders, if they have the national economy in mind, will join management in opposition to its use. The reasons why determination of wages on a basis of ability to pay is unsound are well known:

1. Labor would demand all the gains accruing from technological development and, if it got them, there would remain no incentive for management and investors. Nor would there be price reductions to stimulate increased buying.

2. With the penalty on efficient management which it would constitute, ability to pay would decrease progressively and wages would have to go down along with it.

3. The principle of equal pay for equal work, inherent in the free-enterprise system, would disappear.

4. There would be no uniformity in the wage structure, and something akin to economic chaos would be the result.

5. Labor would have to pay a heavy portion of the cost of business failures.

In the American economy the course of real wages must be upward, or the national standard of living will not advance. But, after all, real wages are the measure of output per man-hour of work, or productivity.

There always has been, and apparently will continue to be, an unwritten but very effective economic law which limits the proportion of factory productivity that may be taken by the workers in the form of wages. For many years this portion has averaged 40 percent. (The tendency toward change, if any, has been in the direction of a decrease in this percentage.) A bigger total productivity, therefore, will mean a bigger value represented by whatever percentage this economic law permits.

The record shows that wages have gone up with productivity, and there is no reason to believe that they will not continue to do so. In the long run labor will have to bargain, and sometimes fight, to get its share of the greater productivity. When the productivity is there, labor will have a sound case and a sympathetic public. It will not be in the position of taking the stand that an emergency wage, brought about by war, must be maintained during peacetime, to keep take-home pay the same regardless of productivity. Such is the action that has put us in our present economic plight.

The tragedy of this economic plight is that we are not getting the one thing we need most—the production of civilian goods. The need and the demand continue, but the goods are not forthcoming.

And when we do get back to work—after the strikes are settled by the granting of somewhat higher wages—our job of lowering production costs will be all the harder.

Yet that is exactly what has to be done. Reductions in cost, reflected in lower prices to consumers, is the only path by which we are going even to approach the millennium of "full employment."

The ability to buy enters the picture. And the ability to buy (on the part of labor and everyone else) will depend upon what we produce at costs that will permit its distribution by the pricing, or competitive, method—and not upon the ability to pay of the individual plant or industry.

L C Morrow

The Only Source of Higher

WHAT SHOULD A MAN DO to get higher wages? Millions of workers have asked that question of themselves, of union leaders, and of company officials. Many misleading answers have been given, and as a result the question is one of the most troublesome of modern times.

Largely because they have been misled by wrong answers, tens of thousands of wage earners are on strike today, and other thousands have been forced into idleness. A multitude of men who want higher wages are getting no wages at all.

The effect of the turmoil over wages strikes even deeper. Because of strikes, the nation's recovery has been slowed down, the road to full employment blocked, and the establishment of higher standards of living postponed.

Of course men can get higher wages by promotion and by upgrading. But that is not the kind of wage increase that is the burning issue in America today. What the average worker wants to know now is how to get higher wages *in his present job.* And the correct answer is:

The only source of higher wages is increased output per man-hour of work.

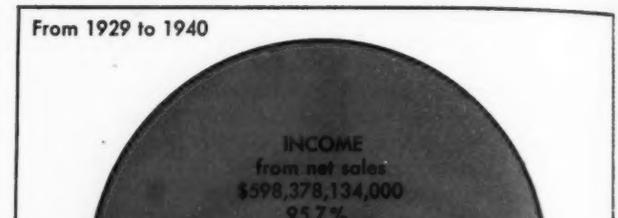
This statement is the key fact which—once understood by both management and labor—could lead to elimination of the basic misunderstandings that bring about strikes for higher wages.

Where Industry Gets Its Income

In any manufacturing company, and in any year, there is only one place wages can come from—i.e., the money that the company takes in when it sells its products to the public. Let's look at the sources of this income, taking the years 1929 to 1940 for specific example. The chart at the top of the next column shows these sources. It is based on government figures.

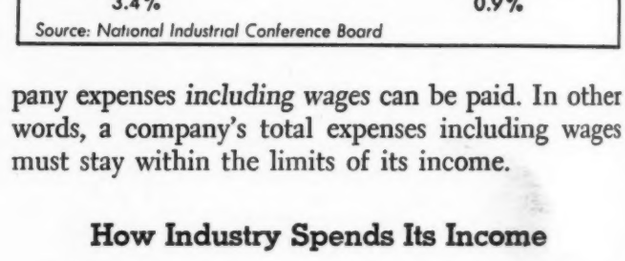
The largest segment of the circle represents money obtained from the sale of products. As its size shows, this is the principal source of income. The smaller segments show that a little additional income is derived from investments in other corporations, interest, rents, and other small sources.

The combined income represented by the whole circle is the only possible source from which company expenses *including* wages can be paid. In other words, a company's total expenses including wages must stay within the limits of its income.



How Industry Spends Its Income

What happens to this money that industry takes in? Where does it go? Here's another circle:



Wages Is Greater Output

It shows expenditures by manufacturing companies from 1929 to 1940. Notice that it is the same size as the previous circle showing income. This is because total expenditures and total income are the same.

Biggest outgo is for materials, fuel, transportation, supplies, and similar essential costs of doing business. Unless these charges are met, the company simply cannot stay in business. The chart shows that these items took away 70.4 percent of all the money that the companies took in.

Companies have to borrow money in order to meet payrolls and other expenses while waiting for their own money to come in from the sale of products. They have to pay interest on this borrowed money. Some companies have to pay rent for their buildings. As the chart shows, 1.5 percent of the income went for charges like these.

Every company must take care of the machinery, equipment, and buildings that it uses. And because these are things that gradually lose their usefulness and value — by wearing out or by becoming obsolete, it is necessary to set aside funds for replacements. The chart shows that replacement of plant and equipment amounted to 3.2 percent of all manufacturing income.

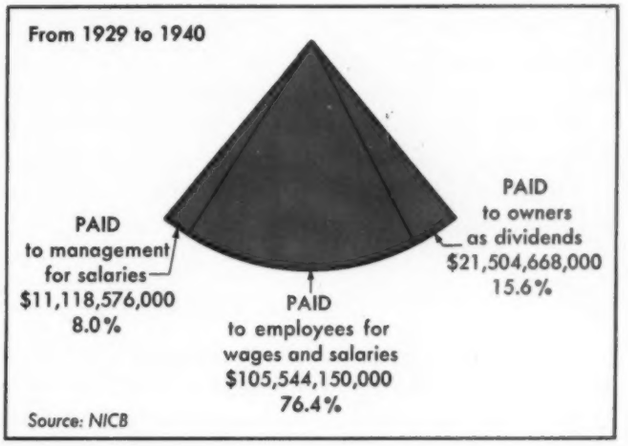
Every manufacturing concern is also obliged to set aside part of its income to be used to pay taxes. Taxes are a "must." If a company fails to save out enough money for federal, state, and local taxes, the sheriff comes around and nails up the doors. The chart shows that, during the period covered, 2.8 percent of total income went for taxes.

Thus a company cannot stay in business unless it spends a large part of its income for materials, fuel, transportation, replacements of machinery and equipment, taxes, interest, and rent. It is therefore the size of these costs and the amount of total income that jointly determine how much money will be left for wages, salaries, and profits.

How Much Went for Wages

Here is what we find. In the 12-year period covered by the chart, what was left after paying these charges averaged 22.1 percent of total income. The remainder, or 22.1 percent, was what was left for wages, salaries, and profits.

How was this 22.1 percent divided? The red wedge from the chart shows the division among employees, officers, and stockholders:



Wage and salaried employees got 76.4 percent. Management got 8.0 percent for salaries. And 15.6 percent was left for profits.

Are Industry's Profits Fair?

Was this division a fair one? Of course no wage earner ever thinks that his wages are too high. No salaried employee ever thinks his salary is too big. Nor is any stockholder likely to believe that profits are any bigger than they should be.

But wage earners and salaried employees might very well feel that profits are too big. So let's look at the facts.

Actually, the amount left as profits for stockholders was only 3.6 percent of total sales. Or, figured another way, the stockholders got only a 3.7 percent return on their investment.

Should Profits Determine Wages?

Are profits a suitable yardstick for wages? No man is to be criticized if he makes the very human mistake of thinking that a company's profits are a suitable yardstick to determine whether it should or should not increase its wages.

For example, in the current General Motors case, the UAW-CIO wants the government to examine the corporation's books, plainly in the hope that the

government will make the amount of profits a guide for measuring wages. And the company contends that it is not proper to try to measure the size of wages by such a yardstick.

Is General Motors right? Or is the union right?

The answer is that profits are *not* a suitable yardstick for wages. Moreover, nothing could be worse for labor than to try to use profits as a measure for wages. Why? Simply because if profits were to be used as a yardstick, then high profits would mean high wages, but low profits should mean low wages.

There are plenty of companies whose profits are low. And plenty of others that have no profits at all.

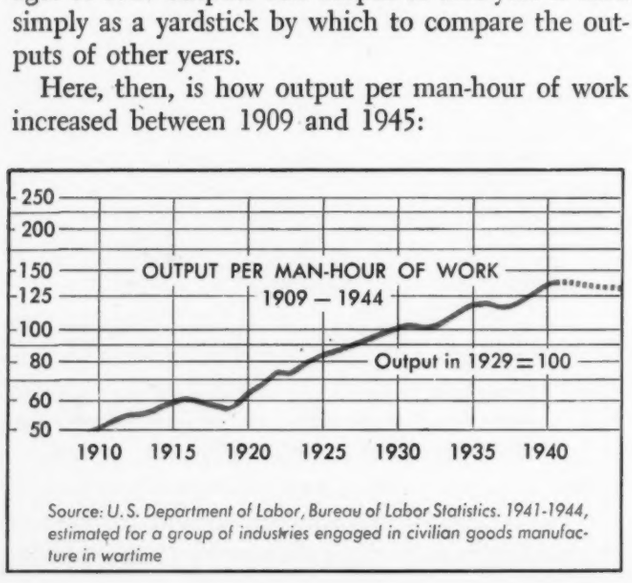
What Has Happened to Output

So far we have shown where industry gets its income, how industry spends its income, and how much of its income is paid out in wages. We are now ready to see what has been happening to output per man-hour of work. Remember we said that increased output is the only source of higher wages.

The next chart shows that, according to government figures, output per man-hour has increased—and that the process has been going on for a long, long time. Later we shall want to comment on the fact that output per man-hour decreased during the war, but for the moment our only interest is in the long-time upward trend.

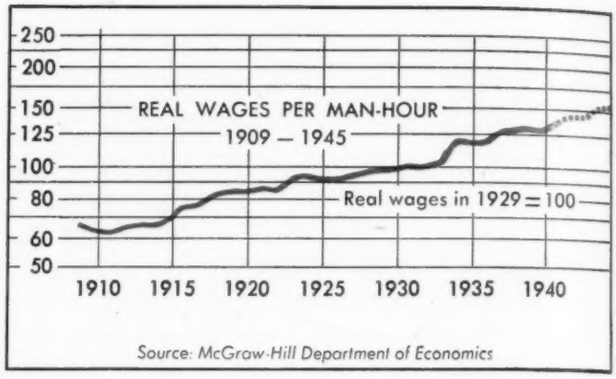
Incidentally, the figures on this chart are not actual output figures. They are really percentages – percentages of 1929 output. The output of that year is used simply as a yardstick by which to compare the outputs of other years.

Here, then, is how output per man-hour of work increased between 1909 and 1945:



Source: U. S. Department of Labor, Bureau of Labor Statistics. 1941-1944, estimated for a group of industries engaged in civilian goods manufacture in wartime

And here, based on government figures, is what happened to wages during the same period:



Source: McGraw-Hill Department of Economics

The figures on this chart are not actual wages. They are percentages of 1929 wages. We do not say that 1929 wages were correct. We use the figure for that year simply as something with which to compare the wages of other years.

Furthermore, the figures on the chart have been adjusted in relation to what the wages would purchase at the time they were paid. This has been done so that it will be fair to compare the wages of any year with the wages of any other year.

For wages adjusted in this way, some people use the term, "real wages." That is fair enough because we are interested only in what the wages will buy.

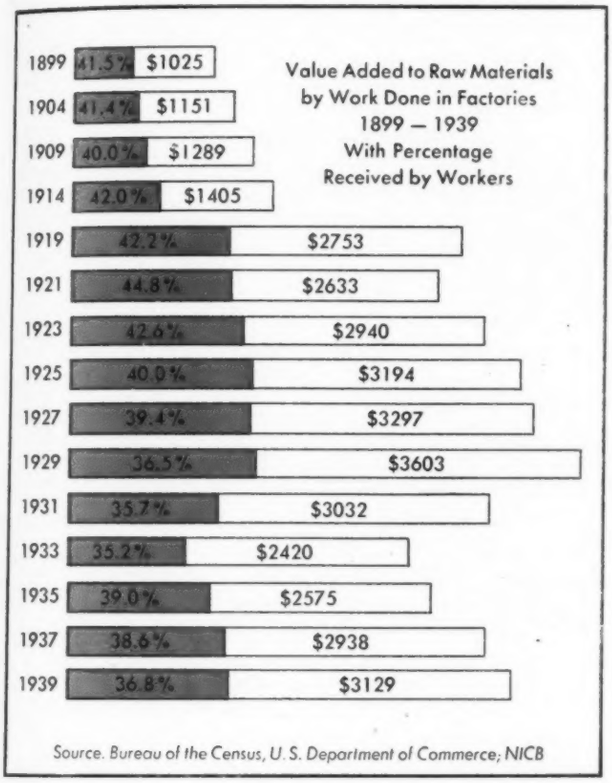
A 10 percent increase in wages would not increase purchasing power at all if the prices of goods also advanced 10 percent. If the prices of goods did not change, the 10 percent increase would represent a 10 percent increase in purchasing power. But a 10 percent increase will represent a 22 percent increase in purchasing power if the prices of goods have been decreased 10 percent at the same time.

Wages — and Work Done in Factories

Another way of looking at output per man-hour of work in relation to wages is to see what has happened as a result of the work done in factories over a long period of years. The way to measure this work is to compare the cost of the raw materials that went into the factories with the prices the factories got for their finished products. The difference is called "value added by manufacture."

In all the records kept by the government it is shown that the wage earner received just about 40

percent of this value added by manufacture. He got the 40 percent whether the country had a depression or a boom, and no matter what political party was in power. Note the chart which shows this relationship by census years from 1899 to 1939. The whole bar in each case represents the value added by manufacture; the red portion indicates the percentage received by the wage earner:

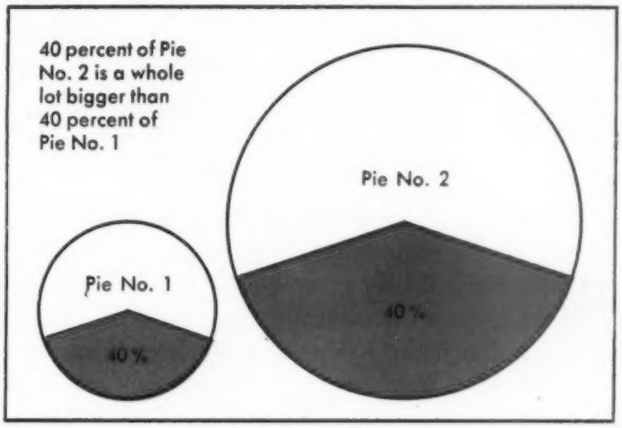


Source. Bureau of the Census, U. S. Department of Commerce; NICB

The fact that this percentage has been pretty much the same under all conditions means that the people who work in factories, plus farmers, plus people in the professions, plus everybody else who gets money for working, can afford to pay to wage earners for their work in factories no more than 40 percent of the value added to materials in those factories. There is no other explanation for this condition. It is simply a fact based on experience which has to be accepted. (There is some indication that this percentage is becoming smaller. And that is a hopeful sign because the figures from past years show that the wage earners in the industries that pay the lower percentages fare better than the wage earners in industries paying the higher percentages.)

A Bigger Piece From a Bigger Pie

How, then, is the factory worker to make any more money for himself? The answer is simple. It is for him and all his fellow-workers and his management to increase the value added by manufacture. Just think of this added value as represented by a pie. The bigger the pie, the bigger 40 percent of it will be. This relationship is shown by the two pies in the chart that follows:

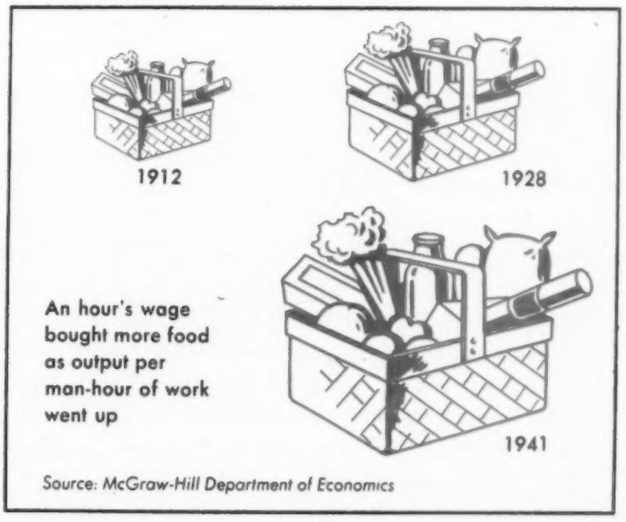


Each of the pies in the above chart represents value added to manufacture. The red slice in each pie is the 40 percent that always goes to the factory worker. It is perfectly obvious that the only way the worker can get more money for himself is to do what he can to help make a bigger pie.

Buying Power Goes Up With Output

We are now ready to see what has been happening to standard of living.

Here's how the buying power of the average American's wages has increased through the years as wages have gone up in response to increased output per man-hour. The baskets represent the amount of food that one hour's wages bought in the years shown:



Source: McGraw-Hill Department of Economics

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The Only Source of Higher Wages Is Greater Output

Of course, improvements in the standard of living did not come in just a few big jumps. They came along, instead, in an almost continuous series of small rises. Some years the gains in wages were greater than in others. This was because in some years the gains in output per man-hour were greater than in others.

How Output Increases

It isn't possible for output per man-hour to increase by the same amount each year. During some years new machinery or new methods are developed that make great increases in output possible. In other years, the increases in output are relatively small.

Also there have been some bad years when improvements have practically come to a halt because of slowdowns and strikes.

Some years, output per man-hour has actually declined. This does not necessarily mean that either management or labor was at fault. For example, although most people suppose that output gained during the recent war years, it actually declined as shown in the chart on page 84. This was largely due to the fact that millions of inexperienced workers were substituted for skilled workers who had gone into the armed services.

This fact is clear, however. Although output sometimes increases rapidly, and at other times increases but slowly, or halts, or declines, *there has been an average gain for many years of approximately 3 percent annually. It is from this 3 percent increase in output that increases in wages have come.*

Why Not Raise Wages First?

There is only one way a company can get more money with which to pay higher *real* wages—through the production and sale of more products.

But why not increase dollar wages and then expect increased production to follow?

Take another look at the chart of output per man-hour and you will see the answer to this question. The chart clearly shows that in some periods output goes up, while in other periods it doesn't.

There are no mystic powers by which we can look into the future and tell what new machinery will be invented, what improvements in production processes will be devised. We can't foretell when employees will be in a mood to push production or in a mood to slow down on the job.

That's why wage increases cannot go ahead of increases in output per man-hour.

If wages are increased first, and the hoped-for increase in production does not develop, factories can either raise prices enough to cover the higher cost of labor, or keep on taking losses until they have no money left to meet payrolls.

Why Not Raise Prices?

Simply because it doesn't work. The wage earner loses as a consumer what he gains as a producer. He is, in short, not a bit better off than he was before. But that is not the whole answer. Large segments of our population whose incomes have not gone up proportionately – farmers and white-collar workers, for instance – cannot buy industry's products. Industry has to stop making them. Eventual result – *fewer jobs.*

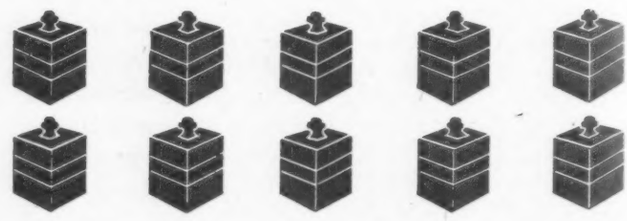
This brings us right back to our chart of output per man-hour of work. As it shows, output per man-hour decreased during the war. It has to gain back all it lost and actually move upward again before higher wages are economically justified.

One Industry's Record

Up to this point, we have been considering all industry. Now let's take a single industry and show how higher wages followed increased output per man-hour of work. The figures we shall use in our illustration are all government figures; they come from the Bureau of Labor Statistics in the U. S. Department of Labor.

In the chemical industry, output per man-hour in 1923 can be represented by these five carboys:

With this as a yardstick, here's what happened to output per man-hour between 1923 and 1940:



Output per man-hour had exactly doubled! And this increase was not the result of a "speed-up" or anything resembling a speed-up. Better methods and better equipment, provided out of the money the industry was able to set aside for improvements, made it possible for chemical workers to increase their output with no more effort – and probably with much less effort – on their part.

While this was going on, sales also increased. Let these five bags of money represent the chemical industry's sales in 1923:

Here is what happened to chemical sales over the 18-year period:

Sales, too, had almost exactly doubled! That was to be expected, because the industry was meanwhile able to cut its unit costs and hence its selling prices. Let's represent the prices of the chemical industry's products in 1923 by these four coins:

Now let's see what happened to selling prices. We are not surprised to find that in 1940 the four coins had become three coins:

In other words, the selling prices of the industry's products had been cut very close to 25 percent – 23.9 percent, to be exact. Part of the gain resulting from the increase in output was thus passed on to the public, which was therefore able to purchase more of the industry's products – which, as we shall see, meant more jobs.

We are now ready for the big question: What happened to wages? Wages in 1929 may be represented by these six coins:

By 1940 the six coins had become ten coins:

Wages had thus increased by 67 percent.

There is one more piece to the picture. What did all this do to employment? Again the record is clear. If we let six men represent employment in the chemical industry in 1923 – as follows:

Then employment in 1940 looked like this:

Employment, in short, had increased almost exactly one-third.

That's the pattern – it's a familiar one in many another industry: Greater output, lower costs, lower prices, increased sales, higher wages, and more jobs. It's the American way.

Conclusion

We conclude, then, as we began – by saying:

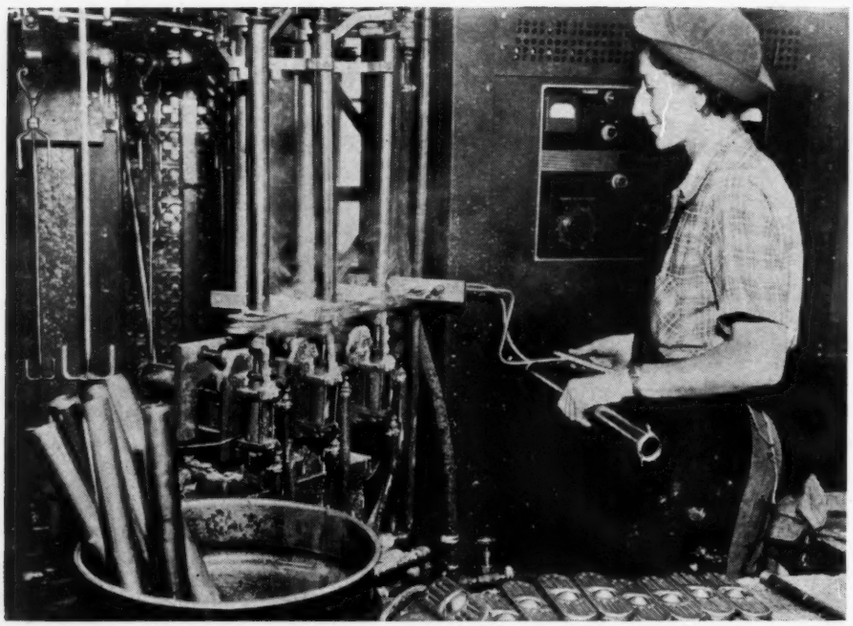
Higher wages can come only from increased output per man-hour of work.

A convenient way to measure this increased output is to compare the values added to raw materials by manufacture. When we do so, we find – according to government records – that wage earners get 40 percent of this added value. Some get more. Some get less. But on the average, over the years, the wage earners get 40 percent.

Let's think again of this value added by manufacture as represented by a pie. The bigger the pie, the bigger 40 percent of it will be.

Only when wage earners and management combine their forces to make a bigger pie, can wage earners make any more real wages for themselves. That is where higher real wages come from.

Mechanized Assembly Cuts Floor Space by Two-Thirds



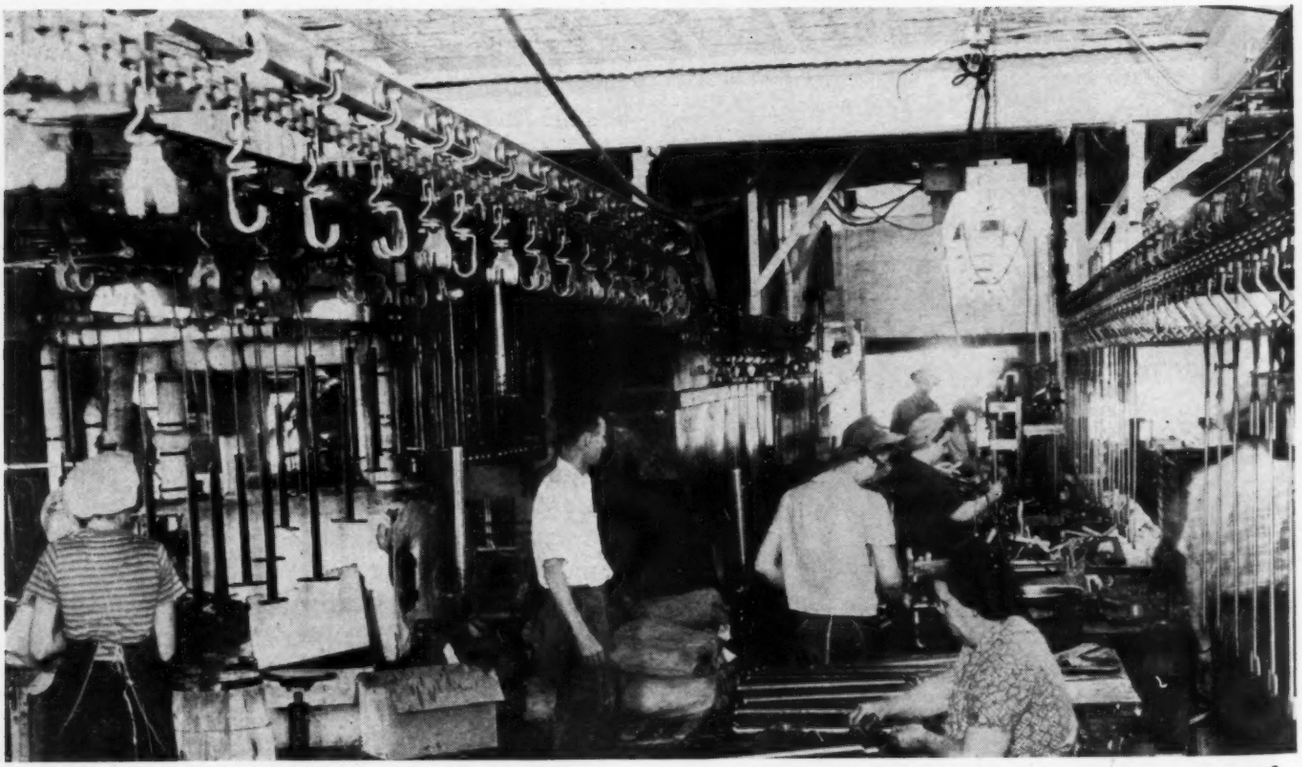
PLANT: Monroe Auto Equipment Company, Petersburg, Mich.

OPERATION: Straight-line assembly of tire pumps.

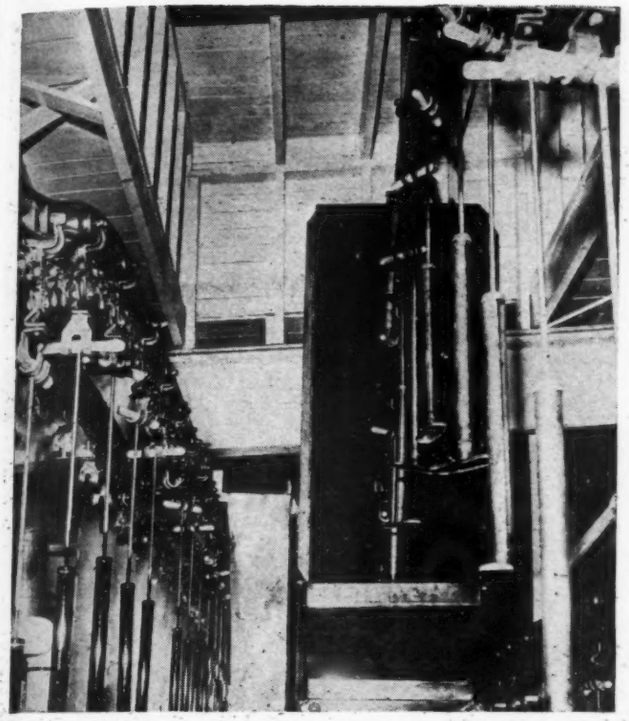
PROCEDURE: Barrels and other parts are produced in the company's main plant at Monroe. Delivered to Petersburg plant by truck. Unloaded by electric monorail hoists. Placed directly on belt conveyors leading to assembly.

SPECIAL FEATURE: Chain and hook conveyor assembly line. Along it, automatic brazing equipment, degreasing and spray paint booths, infra-red drying booths, and other modern equipment.

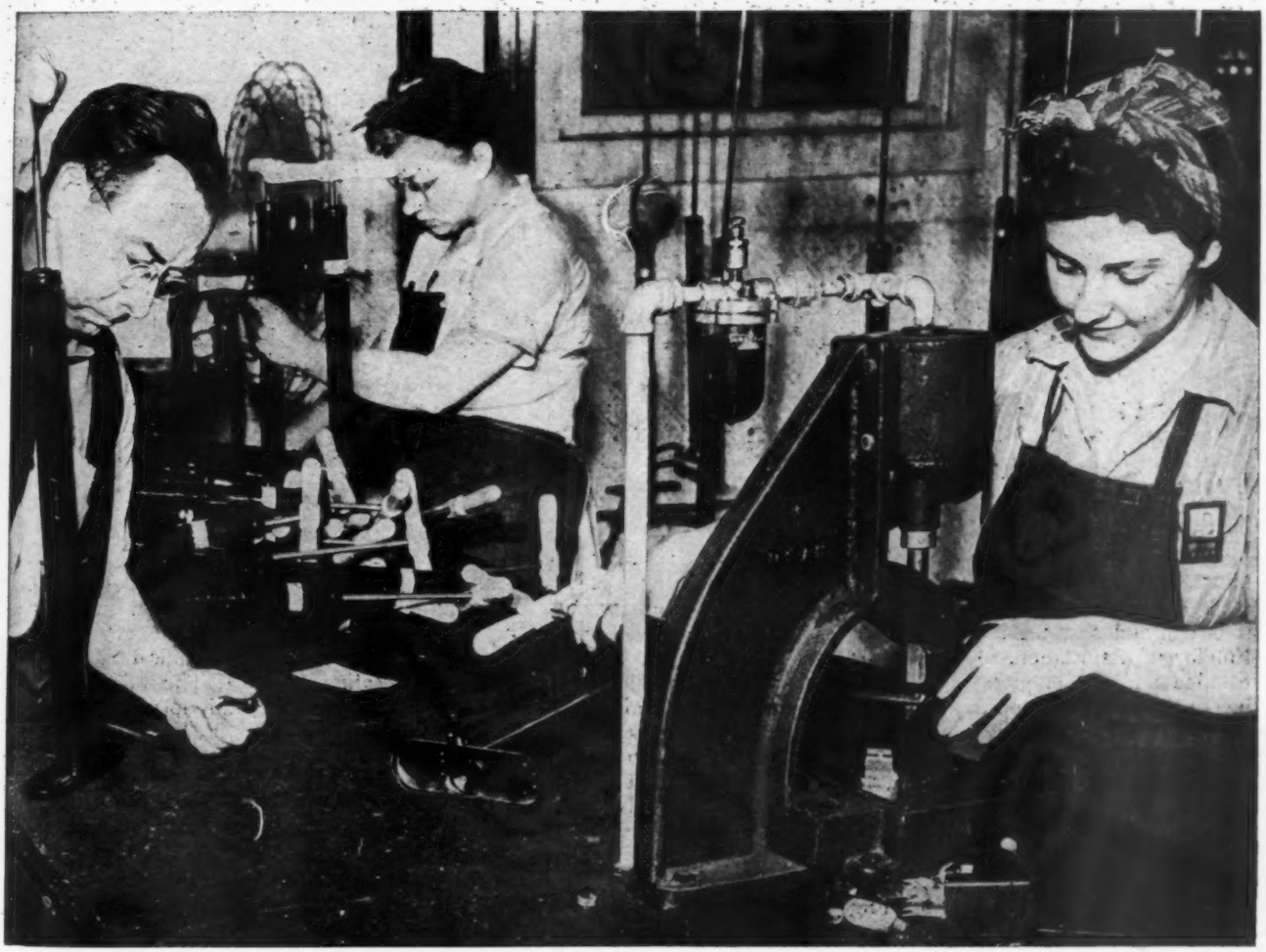
ADVANTAGES: Maximum output. Minimum unit cost. Operation requires only about one-third the floor space normally needed for comparable production.

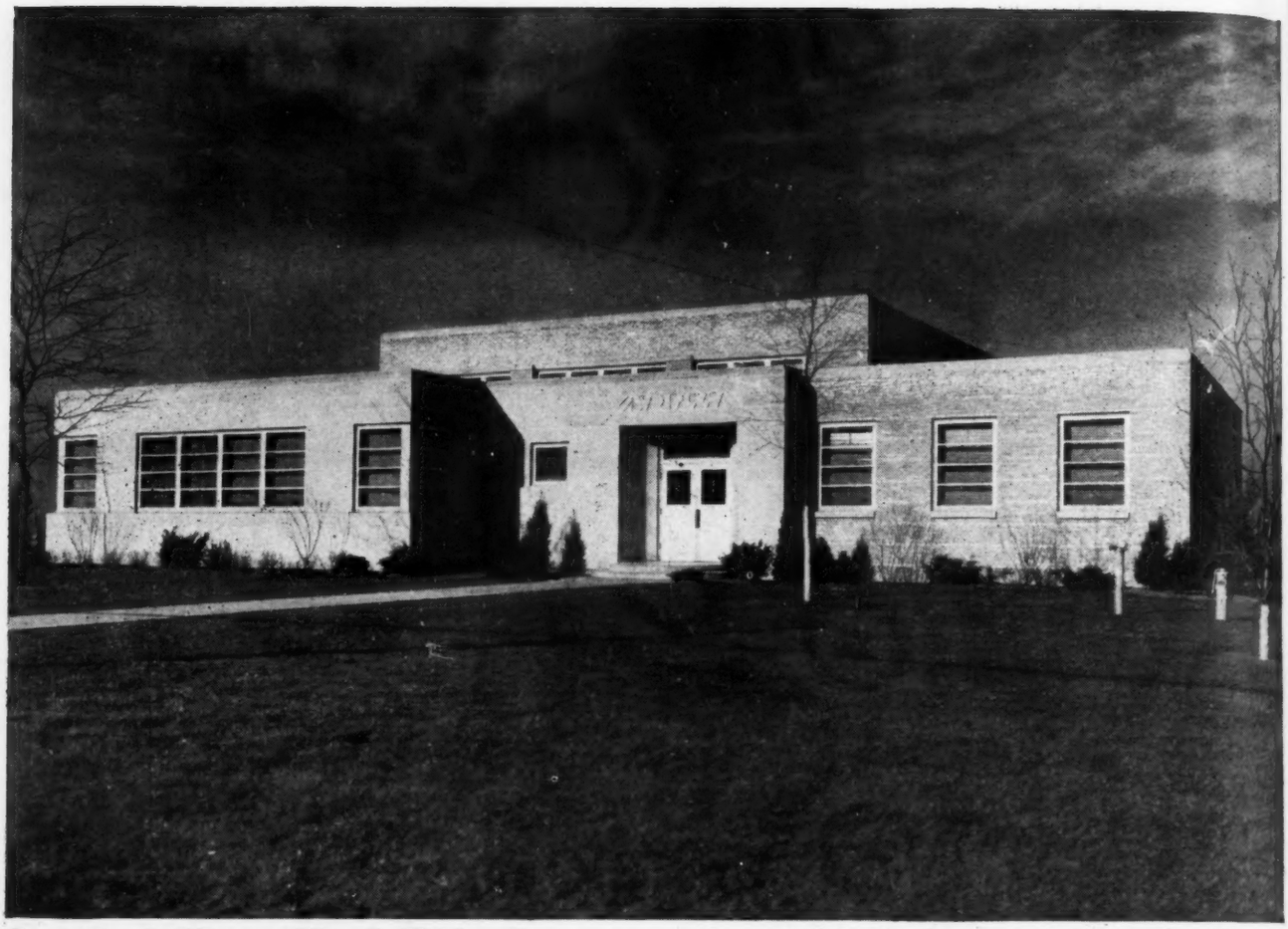


Steady flow is maintained by an automatic welding machine (top photograph) that brazes bases to pump barrels three at a time. Directly above, a general view of the mechanized tire pump assembly line



Above, left, pump barrels are spray-painted as they move through booth on chain conveyor. Right, pumps are taken on conveyor through degreasing booth, there on to spray booth, and finally back and forth through infra-red drying booth. Below, finished pumps off assembly line are tested and inspected





Recreation building at Allen B. Wrisley Company, Chicago, was donated by the company, but is owned and operated by the Employees' Association. Nominal membership dues help meet operating expenses

Workers Own and Operate Their Recreation Building

SHOWN HEREWITH is the recreation building of the employees of the Allen B. Wrisley Company of Chicago. It is owned and operated by the Wrisley Employees' Association, of from eight to nine hundred employees, which is incorporated as a non-profit organization. The income of the organization is received from the company except for nominal membership dues which are used to help meet the operating cost.

The initial step from which the association and the recreation building grew was the setting up by the company of a $25,000 welfare fund. A building committee was appointed, and plans were worked out. It was seen that more money would be needed so another $25,000 was appropriated. Then another $20,000 and then another $10,000. The sum last named was for furnishings and operation.

The land on which the building has been erected is leased to the association, but the association owns the building and equipment. It is expected that a ball field and tennis courts will be provided and that bowling alleys will be installed.

The employee cafeteria is housed in the recreation building. Food is supplied by a caterer service, but there are permanent installations of steam tables, refrigerator, dishwashing equipment.

Features of the building are an acoustical ceiling, asphalt tile, air conditioning (including humidification, cleaning, heating, cooling). The walls are of hollow tile. The built-up roof is insulated and is covered with tar and gravel.

The principal activities up to date are ping-pong and card games, dancing, theater parties organized through the association, a 12-team mixed bowling league, two sponsored men's bowling teams in an industrial league, a sponsored basketball team, a softball team, and many private parties.

Acoustical ceilings, asphalt tile, and air conditioning are features of the recreation building

Food for the employees' cafeteria, which also is in the recreation building, is supplied by a caterer

Setting Time Standards Without a Stopwatch

R. A. OLSEN, Captain, Ordnance, Springfield Armory, Springfield, Mass.

How accurate time standards, used as the basis for incentive payment, may be established without the use of a stopwatch—and how the resulting technique makes for more accurate piece rates than when ordinary time-measuring methods only are used—is illustrated by current practice at the Springfield Armory.

This typical government arsenal has produced 3,500,000 M1 (Garand) rifles in the past seven years. The direct labor charge dropped from $7.52 per rifle in 1941, when no incentives for production were offered, to $6.46 during 1943 and 1944, when the majority of all direct labor charges were paid on an incentive basis. Thus, if no incentives had been offered to Armory workers during the production of the last 2,500,000 guns (January, 1943, to May, 1945), the cost to the taxpayers would have been $2,650,000 more than it actually was. More important to Springfield, approximately 1470 fewer workers were required to obtain this production. Since Springfield was an area with a critical labor shortage, these 1470 workers would have been difficult, if not impossible, to obtain.

Machining MI (Garand) rifle stock—one of the jobs at Springfield Armory whose time values are based on standard movements

Our incentive method of payment, which is responsible for most of the direct labor savings on the M1 over the past four years, has one unusual feature—*the establishment of time standards without the use of a stopwatch or other time-measuring devices.* We use "standard movement time values" and apply them to the fundamental motions, or therbligs, as established by Gilbreth.

The first question the reader will ask is "Why? Why do you set rates without a stopwatch?"

The answer to that question at the Springfield Armory is twofold:

1. It forces the time study observer to make a motion study on every job he times, whether he thinks there are any savings in the job or not. This makes for more accurate piece rates, since the inclusion of unnecessary motions and wasteful effort in a rate causes more inaccurate standards than any other one cause.

2. Government regulations prohibit the use of a stopwatch, but require that piece rates be used wherever applicable.

The two regulations read, in 1941, as follows:

> No part of the appropriations made in this Act shall be available for the salary or pay of any officer, manager, superintendent, foreman, or other person having charge of the work of any employee of the United States Government while making or causing to be made with a stopwatch, or other time-measuring device, a time study of any job of any such employee between the starting and completion thereof.—*Annual Appropriations Acts.*
>
> Such work as can be properly performed under the piecework system should be paid for by the piece.—*Civilian Personnel Regulations.*

Thus regulations prescribe that piecework should be paid whenever possible, but that no time-measuring device be

Table I. Comparison of Minimum Time Values Used at Various Companies

Name	Symbol	Moved at:	Measure Movement of:	Co. A	Co. B	Co. C	Consultant A	Consultant B	Spfld. Armory
Finger	F	Knuckle	Fingertip	140	180	150 190	170	170	170
Hand	H	Wrist	Fingertip	140	200	220	380	235 350	260
Forearm	FA	Elbow	Fingertip	300	167	300	380	285	340
Forearm (hinged)	FA	Elbow	Fingertip	300	167	320	380	210	340
Forearm (rotation)	FA	Elbow	Fingertip	300	413		380	230	340
Full arm	A	Shoulder	Hand	300	213	320	380	325 365	380
Trunk-hip pivot (unsupported)	HP	Hip	Shoulder	650	633	810		820	720*
Trunk-ankle pivot (supported)	AP	Ankle	Hand	515	358				570*
Trunk-ankle & hip pivot (supported)	AHP	Ankle – hip	Hand	650	358				720*
Leg, ordinary (full leg)	LO	Hip	Foot	400	267	350		330	500
Leg, side (full leg)	LS	Hip	Foot	400	325	420		500	500
Knee, ordinary (calf)	KO	Knee	Foot	400	266	350		415	500
Knee, side	KS	Hip – ankle	Knee	400	266	360		475	500
Foot	FT	Ankle	Toe	200		250		295	220
Change standing (moving feet)	MF	Ankle	Shoulder	720		990			800
Change standing (not moving feet)	NMF	Ankle	Shoulder	455		990			500
Change sitting		Ankle	Shoulder	455		690			500
Get up from chair				1500					1700
Walk up to 8 feet									1500
Walk over 8 feet									3440
Inspect									

used to establish piecework. The end-result of this policy has been that each arsenal has had to use whatever methods were available. The most common method was to use production data and so-called production runs of one hour or more. The production, less allowances, resulting from these production runs was used as the piecework figure. Some attempt was made to rate the job, but with inadequate data such rating amounted to little more than a guess.

This method has long been discarded by progressively minded private concerns. As long ago as 1928, the National Metal Trades Association reported that only 16.8 percent of 256 reporting members based piece rate standards on past performance only. Production runs and past performance statistics usually include wasteful or inefficient motions, plus the inept thinking of personnel on incentive. Consequently it can be categorically stated that such methods are inaccurate and should never be used.

With war requiring more and more Garand rifles, the question Springfield Armory management had to decide was:

How can we obtain fair, honest, and accurate piece rates without using a stopwatch?

In 1941, production on the M1 rifle moved out of the design or experimental stage and into mass production. New buildings had been built, modern tools and tooling methods introduced. Production had reached 1000 rifles a day, but management soon realized the impossibility of obtaining top production from its modern equipment unless some incentive were offered to its workers. It firmly determined that, if piecework were introduced, it would be on a sound scientific basis. At this time the standard-movement-time approach was brought up.

Many angles had to be considered. In the first place, the standard-movement-time technique was not too widely known. Competent engineers familiar with it were scarce, if not actually unobtainable. The method was, and is, still young and undeveloped, as attested by the range of time values (see Table I) for the same movements used by various private concerns and consultants. The time values required had to be obtained either through research or through results already worked out by private industry. To complicate the problem still further, departments and foremen were clamoring for rates. The

Table II. Values for Muscular Movem

Name of Movement	Symbol	Moved at	Measure Movement of	Start	Stop	Total Starts and Stops	Travel Time (minute per inch)	Minimum Time
Finger	F	Knuckle		0.00085	0.00085	0.00170		0.00170
Hand	H	Wrist	Fingertip	0.00100	0.00100	0.00200	0.00020	0.00260
Forearm	FA	Elbow	Hand	0.00140	0.00140	0.00280	0.00020	0.00340
Full arm	A	Shoulder	Hand	0.00160	0.00160	0.00320	0.00020	0.00380
Trunk–hip pivot	HP	Hip	Shoulder	0.00300	0.00300	0.00600	0.00040	0.00720
Trunk–ankle pivot	AP	Ankle	Hand	0.00240	0.00240	0.00480	0.00030	0.00570
Trunk–ankle and hip pivot	AHP	Ankle and Hip	Hand	0.00300	0.00300	0.00600	0.00040	0.00720
Leg, ordinary	LO	Hip	Foot	0.00220	0.00220	0.00440	0.00020	0.00500
Leg, side	LS	Hip	Foot	0.00220	0.00220	0.00440	0.00020	0.00500
Knee, ordinary	KO	Knee	Foot	0.00220	0.00220	0.00440	0.00020	0.00500
Knee, side	KS	Hip	Knee	0.00220	0.00220	0.00440	0.00020	0.00500
Change direction	CD							
Change standing (moving feet)	MF	Ankle	Shoulder			0.00800	0.00160/90°	
Change standing (not moving feet)	NMF	Ankle	Shoulder			0.00500	0.00320/90°	
Change sitting	CS	Ankle or Hip	Shoulder			0.00500	0.00320/90°	
Foot	F	Ankle					0.00220/Mvmt.	0.00220
Get up from chair	G						0.01700/Mvmt.	0.01700
Walk up to and including 8 feet	W					0.00330	0.00330/Ft.	0.00412
Walk over 8 feet	W					0.01200	0.00260/Ft.	0.03280 (8 feet)
Focus eyes	FE							0.00200 /Ft.
Inspect	I							0.00300 /Ft.

job had to be done and it had to be done fast.

The standard-movement-time approach was consistent with both the spirit and the letter of government regulations. On the surface it appeared that more time would be required to set each rate, but that this would be offset by increased accuracy in standards. Time was of the essence, but we had to sacrifice something—and time was sacrificed in the interests of accuracy. We now know that this decision was sound. Although it took longer to set each rate, the bottleneck rates could be set rather quickly, and each foreman was satisfied to some extent until all his jobs could be studied.

But what, the reader asks, *is* this standard-movement-time method of setting rates? It is a method in which *the observer establishes standards through the motions and the movements observed rather than through the time values for an operation.*

Students of the scientific method in management will remember that Frederick W. Taylor made the comment, a good many years ago, that studying and timing the same element over and over again in thousands of industrial establishments all over the country constituted waste of just the kind the industrial engineer was attempting to eliminate. For instance, reaching for levers and pushing buttons is being timed over and over again in different plants throughout the country. Taylor thought a time value could be assigned to such operations, and that eventually all operations would have time values. These values could be published in a manual available to all time study men, and future use of stopwatches would be limited to unusual elements.

This theory has remained a dream, more of a textbook fantasy than a practical reality, to most men in industry. Such a manual, they have claimed, would fill many, many volumes. Even if the manual could be developed, its proportions would be so monumental as to render it quite impractical to use.

Lately, however, progressive companies have begun to reconsider the problem. They have now come to the conclusion that the fallacy lies in the

Movements (Minutes)

3 Inches	6 Inches	9 Inches	12 Inches	15 Inches	18 Inches	2 Feet
0.00260						
0.00340	0.00400	0.00460	0.00520			
0.00380	0.00440	0.00500	0.00560	0.00620	0.00680	0.00800
0.00720	0.00840	0.00960	0.01080	0.01200		
0.00570	0.00660	0.00750	0.00840	0.00930	0.01020	
0.00720	0.00840	0.00960	0.01080	0.01200	0.01320	0.01560
0.00500	0.00560	0.00620	0.00680	0.00740		
0.00500	0.00560	0.00620	0.00680			
0.00500	0.00560	0.00620	0.00680			
0.00500	0.00560	0.00620	0.00680			

original conception of an operation. Before Taylor's time, an operation was visualized as a complete procedure such as digging a ditch or making a gear. Over-all times for such operations were all that were considered necessary. With Taylor and time study, a new concept was born—the elemental operation: *Pick up piece, load jig, drill hole.*

Like an element in chemistry, this was considered to be the finest breakdown possible. However, within a few years, Frank Gilbreth had further subdivided the elemental operation into fundamental motions, which he called therbligs. Again these were considered the finest possible subdivision. Yet, just as the chemist has found the elemental atom subdivided into protons and electrons, and the proton further subdivided into other infinitesimal bits of matter and energy, so the industrial engineer has seen his therbligs further subdivided into "movements," which, as we shall see in a second article, may be defined as the muscular reaction required to move a part of the body. Since industrial engineering is primitive compared with the more material sciences, we are still a long way from an absolute scientific subdivision of work. Yet, for the industrial engineer, the concept of "movement" is sufficient as a basis for compiling the manual visualized by Taylor many years ago.

If a standard time is now developed for each movement, plus a standard velocity for each, we find the time question more open to analysis. The study becomes a direct analysis of movement and motion, and not an indirect analysis of the *time* a single operator may take to perform such a movement.

The standard-movement-time approach is a recognition that all movements require a given amount of time for performance. For example, to *transport empty* to an object with the right hand is not influenced, to all practical purposes, by the object; the time allowed is always 0.0044 minute. The grasping of an object is governed by the type of object involved. Thus a tiny object may require two or three finger movements, or may even be preceded by a *search* requiring one finger movement, or one *focus eye*. Such matters can be determined by close observation. The two most variable therbligs, *assemble* and *use*, can also be analyzed for movement. A simo-chart of the classic study of assembling a lock washer, solid washer, and rubber washer would show several *assemble* therbligs. These would be considered as one forearm movement in the case of the steel washers, and two forearm movements for the rubber washer.

Consistent Wages

The standard time values shown in Table II are the times for a thoroughly skilled worker to perform the operation. Allowances are added to lower the production figure required. If the job is of such short duration (two to three weks) that the required skill cannot be built up, a reasonable table of allowances may be developed. The main point is to develop consistency. Equal pay for equal work is a cardinal principle for satisfied employees, and cannot be gained unless take-home wages are consistent throughout each labor grade.

At this point, the question will probably be asked:

"Doesn't stopwatch time study give you just as good results? Why should we go to such an elaborate procedure for setting rates when timing the job is just as good?"

The basic difficulty with all time observation is that a variable observer is watching a variable operator performing an operation with variable skill and variable effort. In other words, too many variables at one time keep the observer from being truly scientific.

Every time study method yet devised has a judgment factor in it, usually called "rating the job." Some methods rate the job four times rather than once, such as the skilled-effort-conditions-consistency method. Others have a rigidly mathematical approach, such as the elaborate minimum time system. At other times, a time that "looks good"

Packaging M1 clips at Springfield Armory—typical of jobs on incentive. Since government regulations prohibit use of a stopwatch to time operations, rates are worked out by standard movement time values

is picked. In many plants today the union has become disgusted with time study and has refused to consider anything but the average time, thus ruling out judgment entirely. The hardest training problem with a new time study man is this mysterious factor called "judgment." And judgment, when a time study man is pressed for time, when he is hot and tired, can all too often be spelled "g-u-e-s-s."

That the problem of "too many variables" is a real one, can be easily seen by the many devices used to standardize the judgment of observers. Most of these are excellent as training methods, and they serve to highlight the importance of this judgment, or rating, factor. Many companies have observers check one another on the same operation, at frequent intervals. Others take motion pictures of a given job, make up a loop, and have rating sessions. By running the motion pictures at various speeds, the ability of the observer to rate, or judge, the speed of the operator is measured. These are all excellent devices, and should be employed wherever stopwatch observation is practiced. Yet no matter how well trained an observer may be, he will still tend to rate *tight* on days when he feels grouchy or ill disposed, and *loose* on bright spring days, or with operators he knows pretty well.

Another limitation of the usual type of time study observation is that the observer spends too much of his time looking at the watch, not enough looking at the operator. Quite often studies can and are taken by sound—i.e., listening for the operator to drop a piece in a totebox, for a press to operate, etc. Although these methods lead to extremely accurate *records* of operator performance, they may cause an observer to miss entirely the fundamental point of the whole study.

One industrial engineer puts it rather colorfully by asking:

"Is your time study department 60 percent blind?"

He claims that the eye is like a motion picture camera—it receives impressions intermittently. While the eye is registering one element in a cycle, the next element or two may be invisible because of the retention of the image of the first element in the retina. This is actual fact, and can be proved by controlled experiment. The observer will find very quickly that the workman has been doing several things that escaped notice at first—i.e., that were invisible to the ordinary observer, yet quite important if speed is desired.

It is poor policy to change rates for minor changes in method, and sometimes rather embarrassing to explain to the boss. It all boils down to the fact that the time study man *must* catch *all* such quick movements, and set his rate accordingly. Time study men get tired, tend to let the little things go. Only by an adequate method of recording each movement will the time study man remain on solid ground.

Those industrial engineers who have been thinking along these lines, and have had unfortunate experiences with the individual, unrelated, uncorrelated time study, are coming to the conclusion that universally applicable time standards must be developed.

The standard-movement-time approach is meant to help this condition. It is not universally applicable. It is still in its infancy. But it will inevitably become more and more popular. Its principle is scientifically sound.

(A second article, describing the standard-movement-time approach used at Springfield Armory as the basis for incentive payment, is scheduled for early publication.)

Mass-Production Layout Techniques in a Job Shop

JOSEPH GOULD, General Foreman, Electrical Equipment Division, Raytheon Manufacturing Company, Waltham, Mass.

How MASS-PRODUCTION TECHNIQUES may be successfully applied to what is primarily a job-shop operation, is well illustrated by current practice at Raytheon Manufacturing Company. Here, conveyorized assembly methods are being used in a department that assembles transformers to customer specifications in lots from 5 to 500.

In making the installation, great care was taken to "sell" employees on the new layout (for details see "Selling the New Layout," FACTORY, November). And no effort was spared to provide the best possible working conditions.

Why the Change-Over

1. **Decrease in personnel**—due to return of many workers to school, tight labor area, high priority on available workers by other divisions of the company, increasing difficulty in replacing normal labor quits.

2. **Improper production flow**—due to space limitations and inefficient travel arrangement of operations.

3. **Too many rejects, not enough output**—due to congested work area, noise, crowded aisles and benches.

4. **Loss of productive space**—due to need to maintain large production storeroom with fairly large staff. Had to route assemblies to stockroom prior to second assembly.

Advantages of New Layout

1. **Maintenance of production,** with decreasing number of workers.

2. **Straight-line flow of production,** with consequent elimination of all bottlenecks and shortening of the manufacturing cycle.

3. **Elimination of congestion,** made possible by keeping floor truck usage to the minimum and by providing three 5-ft. aisles in place of a single aisle which was approximately 4 feet wide.

4. **Less storage area,** with storage between assemblies no longer necessary and only a small stockroom now needed.

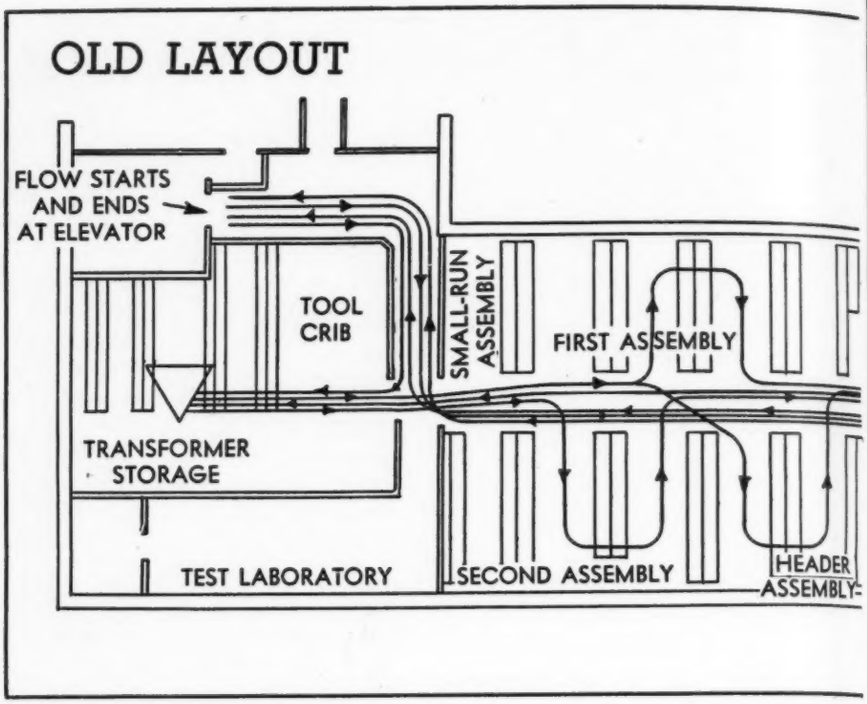
5. **Better quality,** through closer supervision and because rejects caused by handling are held to the minimum.

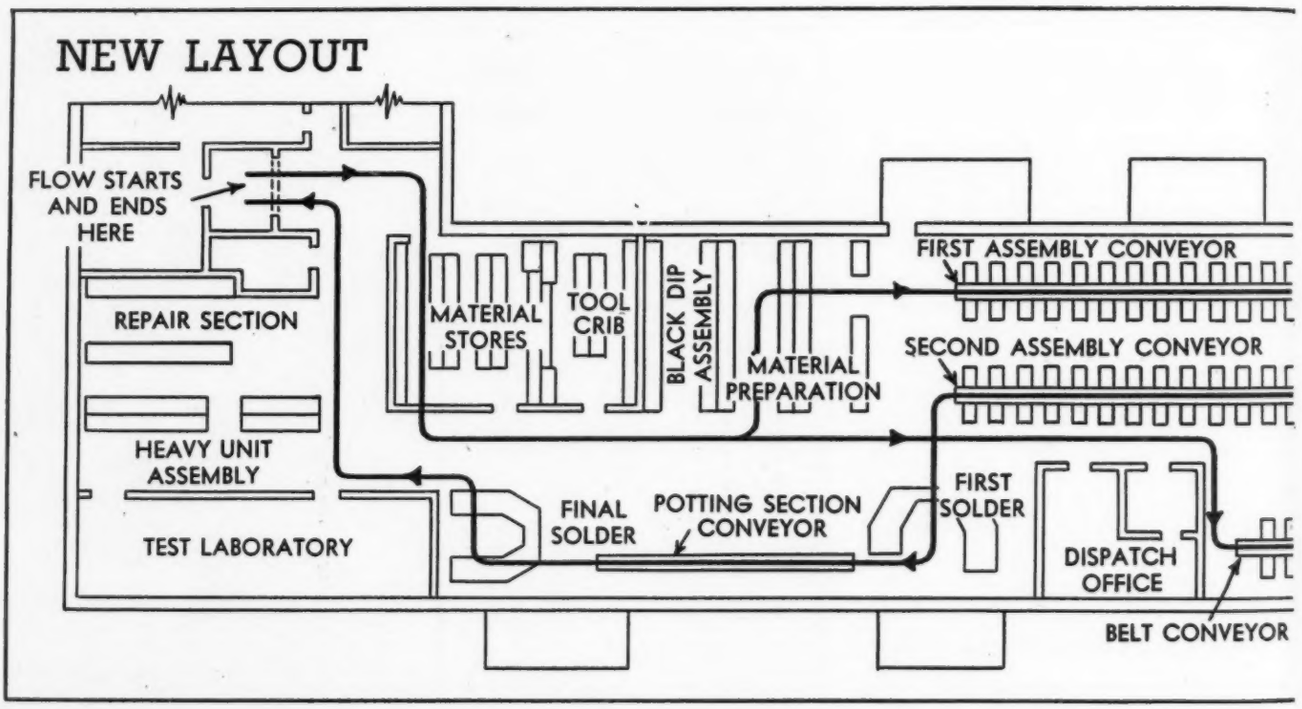
6. **Cleaner work areas,** and consequently the "climate" so necessary for greater output per man-hour.

Conveyor (designated as "second assembly" in new layout on following pages) is one of four used in a department that assembles transformers to customer specifications in lots ranging all the way from 5 to 500

As indicated in the sketches on the following pair of pages, the original layout was built around benches set at right angles to the sidewalls of the

Original transformer assembly layout follows conventional assembly pattern with benches set at right angles to sidewalls of building. Placed back-to-back they formed a succession of working bays. This arrangement encouraged formation of small cliques, chatting, and a certain amount of horseplay. Benches were serviced from push trucks stationed in bays or in aisle at end of benches. Orderly flow of work was impossible. Operators had to service themselves, thus taking much time away from productive work



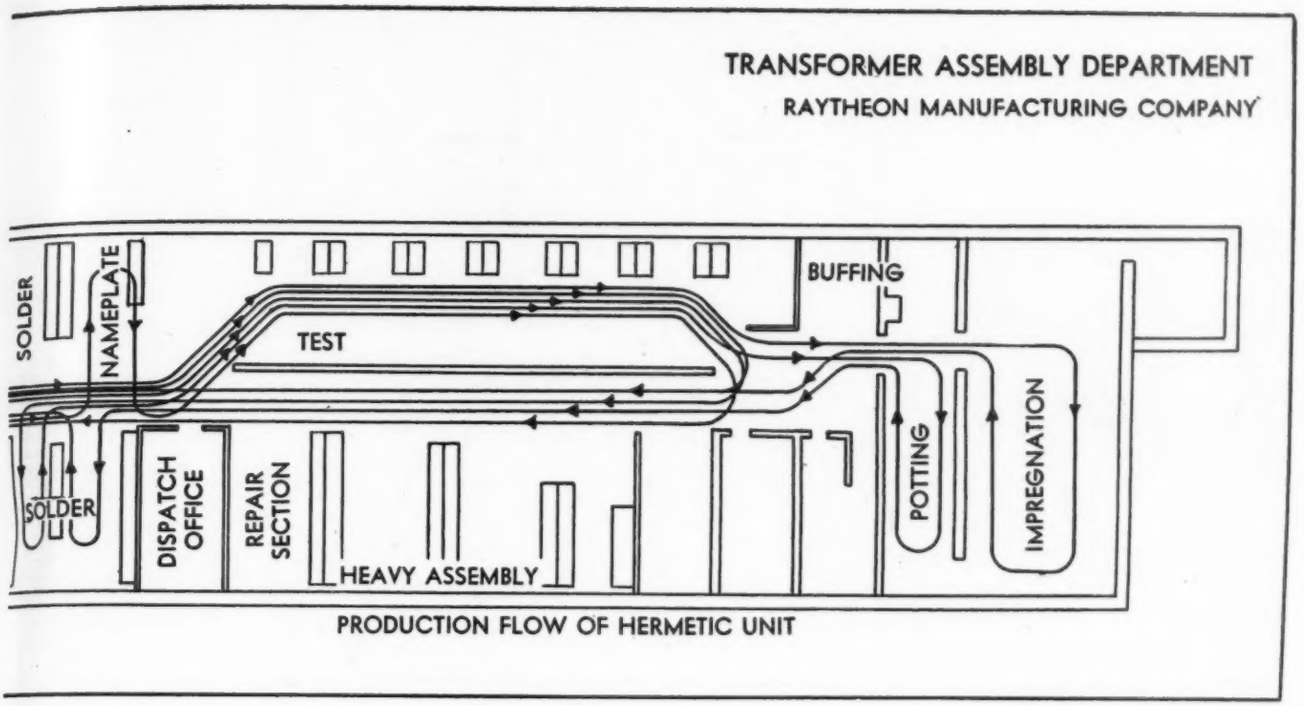


building and placed back to back, thus forming a succession of working "bays." Workbenches were serviced from floor trucks stationed in the bays or in the aisle at the ends of the benches. The confused conditions that resulted may be visualized best by those who have had to put up with similar conditions.

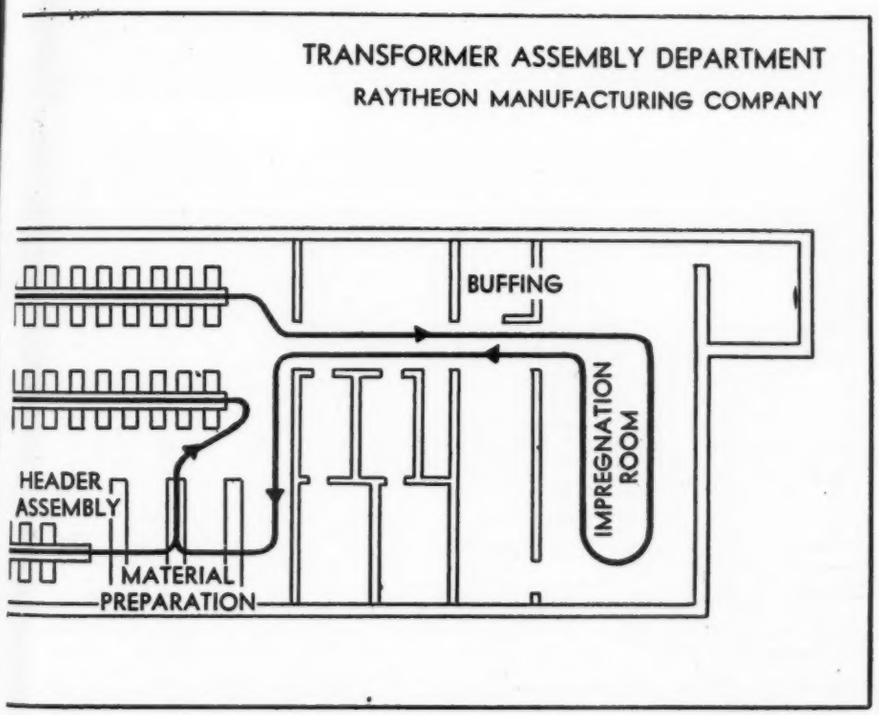
Perhaps the most important contribution of the conveyors is the elimination of the need for the many floor trucks which formerly jammed the production floor. It is now possible for operators to remain at their benches and to occupy themselves continuously in productive effort.

Placing the workbenches at right angles to both sides of each of the conveyors has made easy servicing possible. Also it makes individual instruction and supervision simpler and more effective. This is important because of the need for frequent attention to the work of the operators. In addition, the present workbench set-up makes the handling of materials and finished assemblies to and from the conveyor much less fatiguing; tops of workbenches are flush with the conveyors, which permits sliding heavy units in place of picking them up and conveying them. The mere fact that operators are now able to remain seated all day contributes materially to freedom from fatigue.

Another worth-while feature of the new set-up has been the breaking up of



PRODUCTION FLOW OF HERMETIC UNIT



New layout cuts travel of typical units from 2532 feet to 807 feet, of which 208 feet are conveyorized. Saving in handling is approximately 76 percent. With the old layout, operators spent a quarter of their time in non-productive handling. New assembly methods, alleviation of crowded conditions, and reduced confusion result in a 15 percent labor saving. Also the little cliques encouraged by the bay type of workbench arrangement have been broken up. New front-to-back set-up minimizes distractions and makes for more continuous application to the job

the little cliques that tended to develop with the "bay" type of bench arrangement. The new front-to-back arrangement of benches along the conveyors minimizes distractions and makes for more continuous application to the job.

Indicative of the improved over-all department "tone" is the fact that the transformer assembly department placed first in the company's most recent good housekeeping contest, the only department in the division to achieve this distinction. The operators themselves are more conscious of order and cleanliness now that the previous lack of both has been made so apparent.

Not to be overlooked is the better control of production now made possible. The pre-conveyor situation was such that not infrequently a floor truck would get lost; parts or assemblies on it would thus be tied up for hours. Schedulers and expediters were familiar figures in the department. The new system permits the "logging" of materials and parts to and from the conveyors in a simplified fashion, has reduced the dispatching staff by half.

Units are now inspected and tested on the conveyor. Formerly this work was done in a separate section of the assembly department. The testing operation was a long-time bottleneck and a contributing cause to many failures to meet delivery dates. And, because of the delay between assembly and testing operations, many hours' work—or even a whole day's work—might accumulate before unsatisfactory operating characteristics were spotted.

With inspection and testing on the conveyor, faulty work is spotted at once, and the necessary corrective measures are immediately taken.

Meeting the president (left) in his private office gives new foremen at American Rolling Mill Company an opportunity to see that he's only human, that he too has to work hard for a living. His part in the training program is to help clinch the foreman's natural assumption that he is a part of management

Training Foremen to Play on the Management Team

R. R. TRYON, Assistant Editor, *Factory*

FRIENDLY RELATIONSHIPS of long standing between the upper and lower levels of management at The American Rolling Mill Company, Middletown, Ohio, are being strengthened today by a new brand of training. Specially designed to induct new foremen into the Armco family in groups of seven men each, but now including older foremen and supervisors also, this program of employee relations *within management* serves to dispel any possible suggestions that foremen do not play on the management team. Out of it all come foremen who know exactly where they stand and who go back to their jobs with a clearer understanding of "what it's all about."

A cordial attitude has existed for a great many years between foremen and top management at Armco. In the early days this attitude was simply a general response to the friendly conduct of top officials in their casual and official contacts with those of lower rank.

Today the initiative toward a friendly attitude among the various levels of management still comes from the top, and still is instinctive and natural. But today the conditions in which friendly relationships thrive are *deliberately planned.*

First step in the program for good relations between top management and foremen is to make sure the foremen have been wisely chosen. The need for this precaution was discovered rather early in the development of the present program because of unsatisfactory results from a rather large number of what Armco calls "midnight selections." The term came into common usage because frequently on a night shift or at some other time in the absence of a top management official, an unexpected need would arise for immediate promotion of some ordinary worker to the status of foreman. Too often the ap-

pointee was equipped with excellent skills—for everything but foremanship.

For a time the company considered the possibility of singling out a number of likely prospects and giving them advance training while waiting for possible openings to develop. The fault with this procedure, Armco believed, would be that when these men returned to their regular jobs on completion of training, they would be "neither fish nor fowl." This in-between status would make them targets of fellow-workers' jealousy and suspicion.

Selection troubles of the type cited are eliminated by the present method. The company still keeps in mind a number of candidates for every promotional possibility, but it does not give them any advance training or even let them know they are being considered.

Moreover, Armco has arrived at the conclusion that there is little need for special advance training of foremen. Since it follows a policy of promoting from within, almost invariably its candidates for foremen are men who already know from experience in their present jobs all the technical requirements that they would handle as foremen. As for the additional managerial knowledge that they may not have had opportunity to acquire, Armco takes the view that there is time enough to give them that after the promotions have been made.

Thus, even if a new foreman must serve a few days or a few weeks in his new job before time can be taken out for special training, no serious harm is likely to occur in this short interval. Effort is made to begin the special training at the same time the new foreman is appointed, but in case of a short delay he can still get along temporarily through assistance given by other members of management. Incidentally, a slight delay in the training usually makes the new appointee all the more anxious to participate in it, because the delay has given him time to become secretly aware of some of his own shortcomings.

Series of Meetings

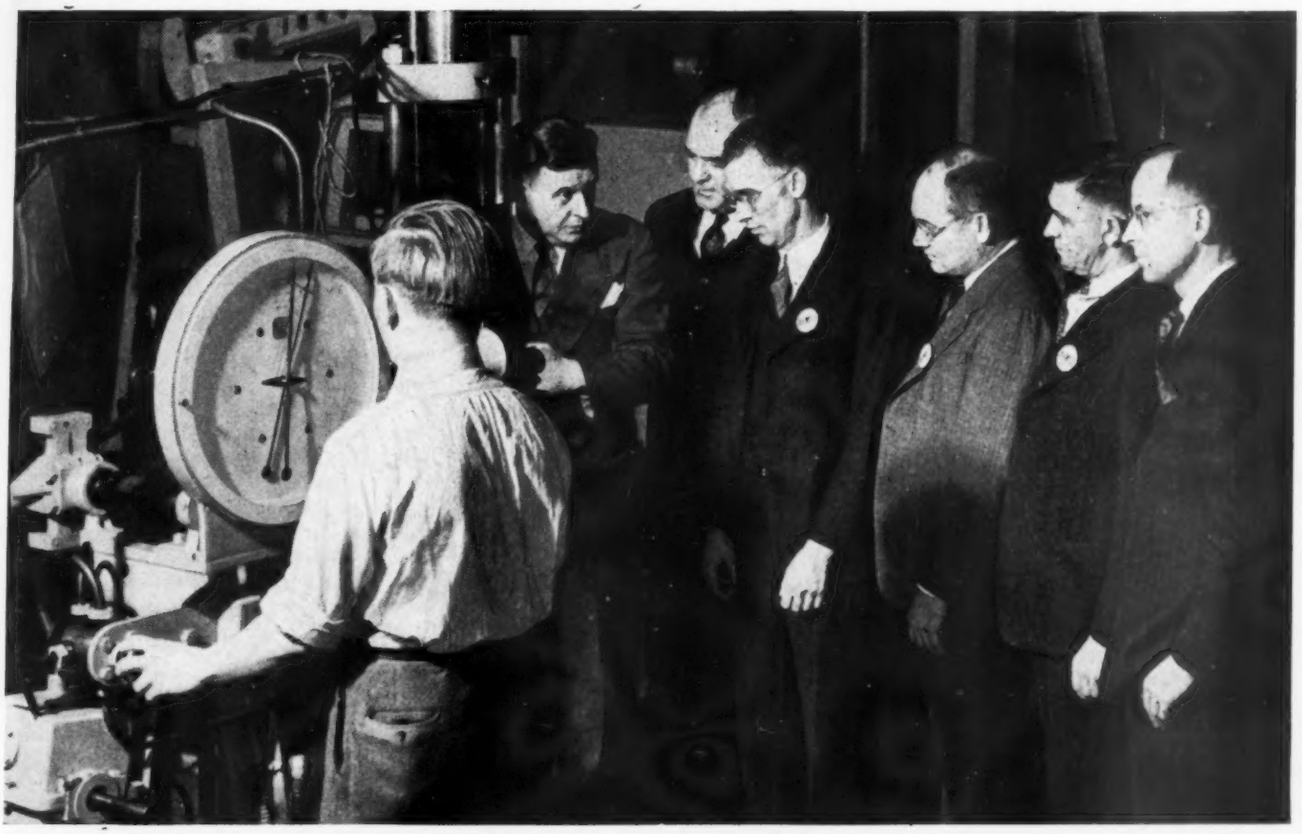
The special training of foremen begins with a 5-day series of meetings, lectures, and conferences with top management at the main offices of the company. Participants are brought to headquarters in groups of seven. Some come from the main plant in Middletown; others from branch plants in other cities and states. Some come from blast furnace plants; others from rolling and fabricating mills. Even Armco's coal mine enterprises and its Ohio River barge transportation department are sometimes represented.

The company pays the traveling expenses of the visitors, and provides their hotel accomodations and meals while they are participants in the program.

A standard schedule for the week, prepared by the training department, is followed as closely as possible for each group. This begins with an introductory address by the staff supervisor of training, usually at 9 o'clock on a Monday morning.

Along about 10:30, the new foremen—and occasionally a foreman of long standing who has been added to the class—go to the office of the director of personal relations. Here for more than an hour the director discusses the personal problems of foremen. This discussion includes such matters as the foreman's standing in the community, his conduct away from the plant as well as in it, his financial affairs, his part in the company management, and his opportunity for further education and advancement.

In the afternoon the foremen participate in conferences with the supervisor of public relations, and with the supervisor of employment and insurance. The



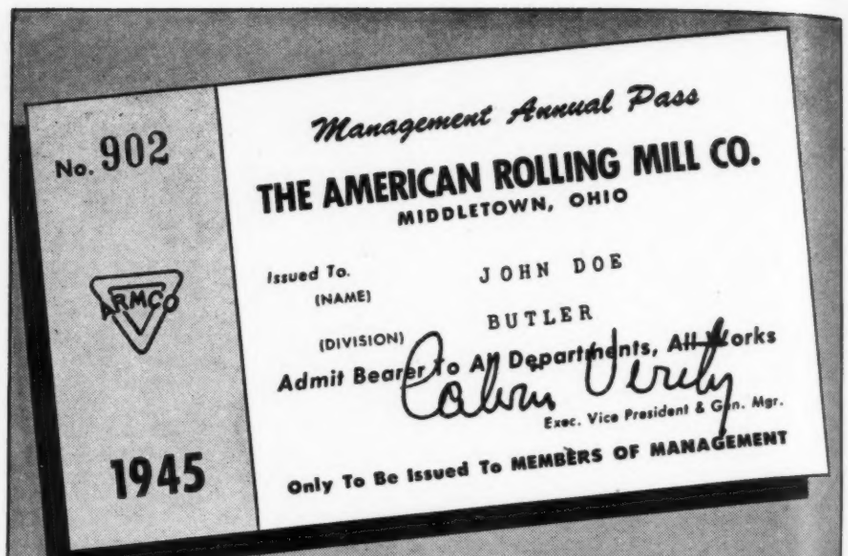
Foremen feel their position in management more surely when they are better acquainted with other departments, hence every new supervisor gets ample time for a series of departmental tours

former goes into the history of the company, showing the continuity of its employment opportunities and growth, and the function it has performed in the national and local social structures. The latter explains the employee selection procedure and policies, and discusses human relations in general.

During the evening the foremen are taken on an inspection tour of some part of the plant.

Generally in the forenoon of the second day the new supervisory appointees participate in a 1-hour conference with the president of the company. This is held in the president's private office. The staff supervisor of training is also present.

The president's conference and all similar meetings of the foremen with company officials are completely informal. Each foreman is greeted personally by the president and is made to feel at ease. Ensuing conversation, incoming telephone calls, and the general aspects of the office quickly make it clear to the foremen that *the president is a man who also works for his living.* The visit also gives the foremen ample opportunity to perceive that the infrequency with which the president may meet them on other occasions is not an indication that he is lacking in friendliness, but rather that with his manifold responsibilities for the conduct of the company's business he is probably even busier than they are.



Only members of management get special passes admitting them to all departments, all works, at Armco. These cards are among the several distinctive evidences of membership in management given to foremen

Management's Duties

The subject of the president's talk to the foremen concerns the management functions they perform. He makes it clear that the distinguishing characteristic of every member of management is the execution of certain orders and policies of the company. It is pointed out that the duties relating to orders and policies necessarily vary from one member of management to another, but that all are part and parcel of the whole. By such presentation of the facts, the foreman's natural assumption that he is a manager, and therefore is a part of management, is clinched. Simultaneously it becomes evident to the foremen that it is impossible for them to give orders and administer policies of the company if they are simultaneously in alliance with non-management groups which may be opposed to acceptance of the same orders and policies.

A similar atmosphere of "all-one-team" prevails in each of the successive conferences held with more than a dozen of Armco's top officials. Furthering this impression are repeated invitations to the foremen to join in open discussions at each conference.

When these top management officials talk to the foremen about the present and future prospects of the company, much of their conversation is "thinking out loud." Since this thinking out loud is on big topics, the foremen present fall into the habit of "thinking big" with them, and, as the foremen do that, the operations of the company are seen in new perspective.

One of the most productive of the conference topics in giving the foremen a better perspective of the company and a more solid feeling of unity in management is a discussion by the general manager of the financial background and expansion of Armco. This session gets right down to fundamentals of economics, shows how every job in the company was created by investment of capital, and how relatively little return is received by the investors in proportion to the risks they have taken and the benefits their investments have made possible for all employees on the payroll.

Problems Discussed

Here the foremen are also given a new insight into corporate financial problems. For example, it may be shown that a production schedule for a specified tonnage from one of Armco's coal mines is not merely an arbitrary figure. Instead, the specific breakdown of operating costs may be displayed and explained to show that a proportionate lowering of the gross revenue may have a disproportionate final effect; that it may convert a thin margin of profit into a wide margin of loss.

Similarly, a discussion of conditions in the nation's markets for materials may show the foremen why the management has found it necessary perhaps to abandon some phase of operations and to seek a replacement for it. Or the same discussion may show why rush work in one department may be needed to prevent a shutdown in some other department, even in another city.

A New Viewpoint

Most new foremen are insufficiently aware that such problems exist, and that it is only through mental and physical labor on the part of top management that the problems are solved and payrolls are met. But before Armco's freshman foremen have completed their week at headquarters they have a new insight not only into their own respective jobs; they also have a new appreciation of what the rest of management is doing.

Usually the general manager's meeting with the foremen is on the third day of the schedule, after another plant tour on the previous afternoon. Also on the third day the foremen hear a detailed discussion of the company's written code of policies. This is given by the supervisor of training. And there are talks on accident prevention by the supervisor of safety, and on wage administration by the supervisor of compensation and records.

Evening of the third day finds the foremen listening to the assistant manager of the fabricating division discuss its history and products. This meeting

is the prologue to a tour of the fabricating division.

In a small company it might seem completely unnecessary and a waste of time for employees to do much touring in the plants of the company that employs them. But in a company as large as Armco, and doubtless in many others not nearly so large, it is surprising how much benefit is derived by having the foremen get a first-hand impression of what departments other than their own are like.

In the tour of Armco's fabricating division, for example, mine foremen from West Virginia see that their job at the mines is not merely to produce coal, but rather to contribute to the manufacture of end-products of many varieties. Blast furnace foremen see that instead of producing huge rivers of molten steel, they are actually producing the materials needed to manufacture pipe to carry water for people to drink, or perhaps corrugated sheets for highway culverts.

See Need for Teamwork

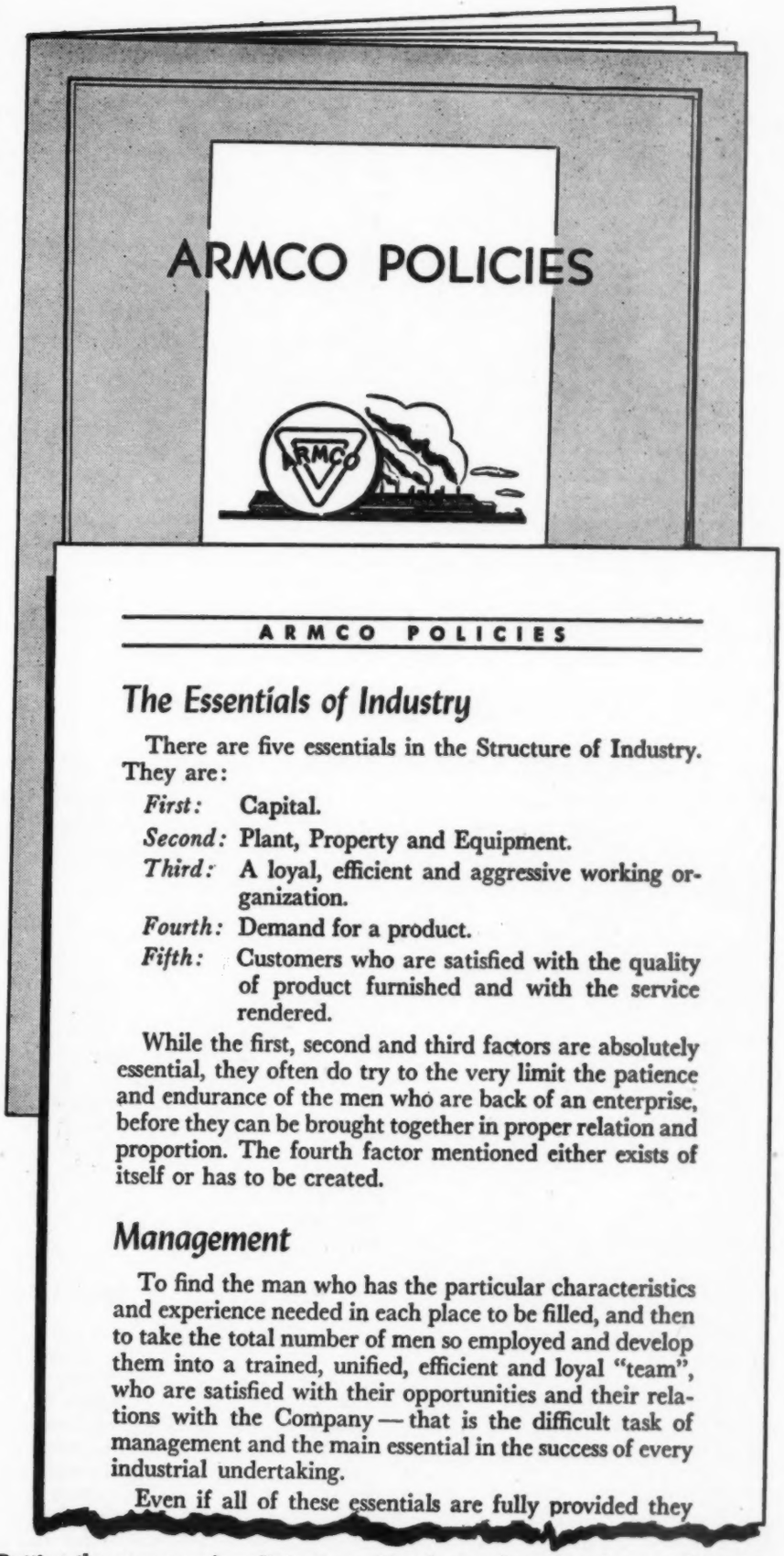
Thus the visitors see that back in their own jobs they are playing on a team which has an important function in society. Also they see that each part of the team is dependent for its operations upon the proper functioning of all the other parts. Out of it all emerges a bigger and stronger feeling that no member of the team should let the other members down.

International activities in steel trade are discussed by one of the top officials of the Armco International Corporation at the first meeting on the fourth day.

Then the vice-president in charge of mining and manufacturing discusses his field of activities, and goes on to explain the importance of foremen development. Here also there is discussion of the long-range view of the industry.

In this meeting the vice-president goes into considerable detail, but in an informal manner, about the company's sources of materials, the problems of producing and transporting them, the financial aspects of meeting production schedules, and the problems related to final manufacture. Most of this discussion puts an entirely new light on familiar problems and the rest of it develops and explains problems and solutions which many of the foremen had never realized existed.

A trip through the research laboratory and a discussion of the relation of research to operations take all of the fourth afternoon. From this experience comes a new realization on the part of the foremen that large sums of money spent for research are well spent—because of the contribution made by


ARMCO POLICIES
ARMCO
ARMCO POLICIES
The Essentials of Industry
There are five essentials in the Structure of Industry. They are:
First: Capital.
Second: Plant, Property and Equipment.
Third: A loyal, efficient and aggressive working organization.
Fourth: Demand for a product.
Fifth: Customers who are satisfied with the quality of product furnished and with the service rendered.
While the first, second and third factors are absolutely essential, they often do try to the very limit the patience and endurance of the men who are back of an enterprise, before they can be brought together in proper relation and proportion. The fourth factor mentioned either exists of itself or has to be created.
Management
To find the man who has the particular characteristics and experience needed in each place to be filled, and then to take the total number of men so employed and develop them into a trained, unified, efficient and loyal "team", who are satisfied with their opportunities and their relations with the Company — that is the difficult task of management and the main essential in the success of every industrial undertaking.
Even if all of these essentials are fully provided they

Putting the company's policies in writing keeps them free from ambiguity. A 16-page booklet of these policies is one of the principal items included in the notebook furnished to new foremen while they are being trained

research to the growth of the business and of job opportunities. Foremen also come to realize that pure research as opposed to the practical variety is a productive field for corporate enterprise.

Friday's sessions begin with a talk by the assistant general manager "What we must do to keep ahead in the steel industry." At this meeting the foremen are given a point-by-point analysis not only of essential steps for the company as a whole, but also of the essential steps that must be taken by management.

This discussion leads naturally to another—given by the supervisor of training—which stresses the responsibilities of foremen. Here the leadership requirements of foremen are among the main points stressed.

Preventive maintenance is the topic of the final conference in which the general maintenance engineer drives home the point that losses caused by failure of maintenance have a direct effect on everyone in the company. Also stressed, with suitable examples, is how the failure of a seemingly small item may cause damage far in excess of the item's apparent importance, and how small losses individually total large losses when they occur in large numbers. Here also the foremen are reminded of their obligation to cooperate with the maintenance department by reporting any unusual matters requiring maintenance attention, and by willingness to sacrifice some production if necessary to provide opportunity for the application of maintenance measures.

Concluding the week's program there is a general summary presented by the supervisor of training.

Home Plant Training

The week at headquarters is not the only training that the foreman gets. After each foreman has returned to his job, he spends the greater part of a second week in his own plant attending a supplementary series of meetings. Here he discusses with his works manager the information gained at headquarters. Then the foreman spends a series of half-days in the employment, accounting, engineering, purchases and stores, safety, and other departments.

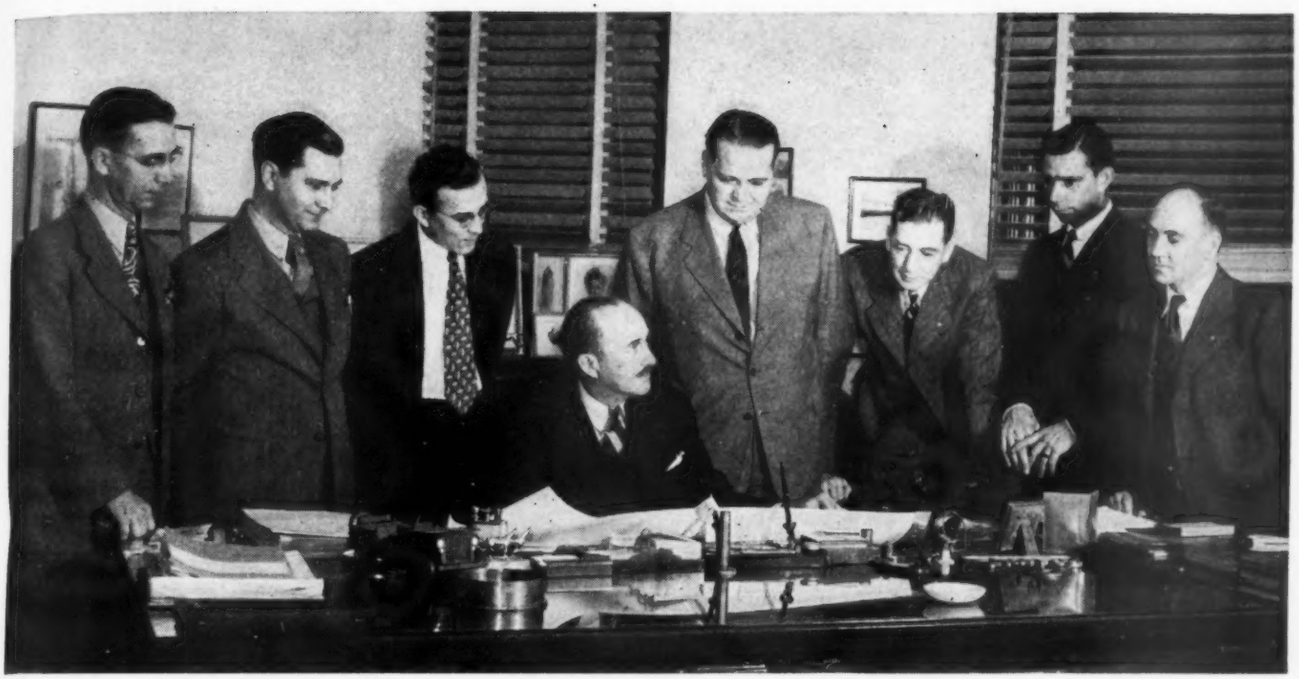
These meetings acquaint the foremen with the general operations in his own plant, so that in any future contacts with the various departments he will feel more self-confident and will be better informed.

There are other details in inducting the new foreman that tend to emphasize his part in management. For example, every Armco foreman receives an identification pass of a type used only by members of management. This pass has a distinctive blue color, is signed by the executive vice-president and general manager, and is plainly marked: *"Only to be issued to members of management."* Almost all foremen at Armco have the use of a desk and telephone. And they are spared the necessity of standing in the pay line like the rank and file. Instead, a representative of the paymaster's office delivers their salary checks.

These marks of special distinction are important among the factors that make the foreman's job desirable to him. They are important reminders that his efforts to win a place in management were worth it. But, more than that, they are continuous reminders that he is a member of management in fact.

At the current rate at which the classes of seven are being handled, it

Getting the foremen better acquainted with a wide variety of details about the company is one of the jobs of the director of training. Loose-leaf notebooks contain supplementary literature



Foremen get behind the general manager's desk, in Armco's training program, to study a typical problem from the same angle that top management sees it. Afterward, foremen have a better appreciation of the part top management plays, and a better grasp of their own role in the management structure

will be possible not only to put all new foremen through the week at headquarters but also gradually to bring in several hundred others who became foremen before the present program was put in effect.

It all takes time. And it does cost money. Yet, in spite of the personal attention that the conferences require week after week from a dozen or more members of the company's top management, the total time demanded of them for this important management-relations program is very much less than casual thought suggests. The actual time required of the president, for example, is only one hour a week, and at Armco this is not believed to be too much for the president to spend directly for the maintenance of a high standard of management relations.

Similarly, Armco's top management believes the time required of the visiting foremen is well spent. After all, a full week is only 2 percent of a foreman's year, and it is far less than 2 percent of the total time that the average foreman spends on the job thereafter.

As the result of these conferences, the foreman goes back to his job with a better attitude toward the company, toward top management, toward the personnel of his own department, and toward the functions of his own job.

For example, toward the company there is no longer any feeling that it is simply a structure of machinery, buildings, and money. Instead, the company is seen as association of people in which the foreman has a leading part, and the machinery, buildings, and money are seen as simply the tools with which these people perform certain functions.

Likewise, toward top management there is no longer any feeling that it consists of high-hat individuals who are little more than figureheads, with easy jobs, and little relationship to foremen. Instead, top management has been found to consist of human beings of more than average friendliness, occupying "hot-spot" jobs, and performing functions of a managerial nature related directly to the managerial functions performed by the foremen.

Most important, these attitudes are not the product of second-hand information. They stem from facts the foreman has "seen with his own eyes" —and "right in the boss's own office!" That kind of knowledge cannot easily be shaken.

THE AMERICAN WAY

1. The job of American industry, management, and labor is to make at lower and lower cost more and better products to sell for lower and lower prices.

2. The only way that job can be done is through understanding and sensible cooperation between management and labor.

3. The spirit of that cooperation must be a sense of joint responsibility. The public is the "boss," not management or labor. Both labor and management must accept their share of responsibility to the public welfare and live up to their commitments.

4. Mass production has demonstrated its ability to bring high wages, and higher wages can come only out of greater production and lower costs.

5. While no single human institution or industry can promise complete security because of the complexity of modern civilization, management and labor can work toward certain, more stabilized employment.

6. American industry should be a place of opportunity, a place in which men and women can grow and develop into better jobs.

—Henry Ford 2, President, Ford Motor Company

Saving Space With Vertical

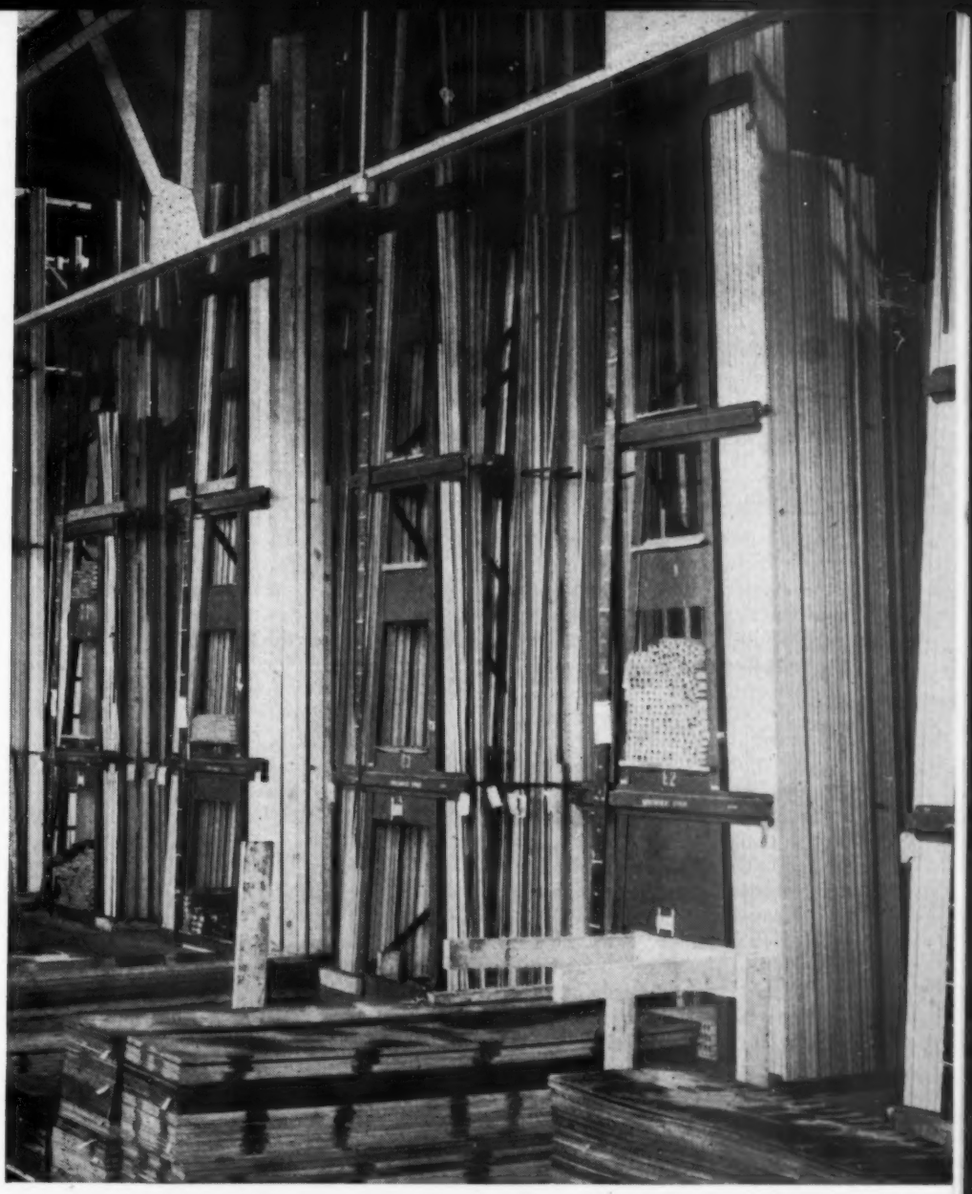
Storage

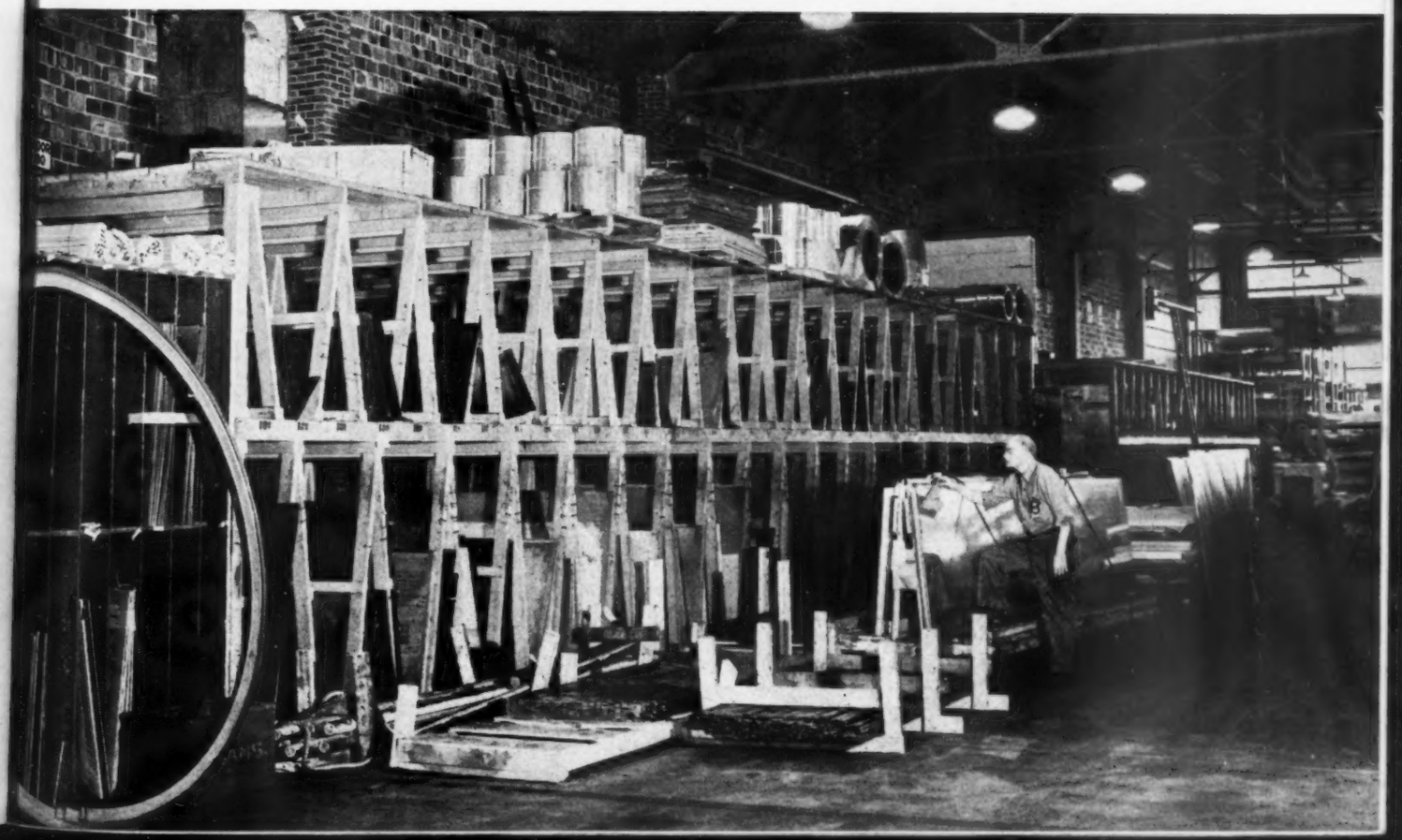
★ **PROBLEM:** Boeing Aircraft Company, Seattle, has to stock a large number of stringers—long pieces of formed or extruded aluminum alloy—used as stiffeners in its new double-decked commercial airliner, the Stratocruiser.

★ **SOLUTION:** Vertical storage. Elongated A frames are used subdivided for segregation of materials by type and length. Typical A frame (see photograph on facing page, also photograph at right) is 6 feet wide at the base, has a peak height of 24 feet, and is 16 feet long, with each of the two faces subdivided into four 4-ft. bins. A foot scale is attached to outer face of frame.

Frames are built of 2x6 and 1x6 boards, and each of the five A trusses in a frame has two horizontal crossbraces. Braces provide "pigeonhole" horizontal storage space within each frame, thereby making a further contribution to floor space economy.

For vertical storage of sheet material (see photograph below), smaller A frames are used. These frames have "feet" on which the lower edges of the sheets may rest. They are built in such a way that they may be lifted pallet-wise by a fork truck, permitting a double-deck arrangement that makes an important saving in floor space.





Shall Labor Bargain With Government or Employers?

WHITING WILLIAMS, Consulting Editor, *Factory*

"STOP TINKERING with the country's economic system," so CIO President Murray is reported to have lately told his associates, his eyes on Walter Reuther, "and get on with the old-fashioned union business of winning higher wages for workers!"

This advice should have been hailed by all industrial employers. For it indicated that this labor strategist recognized the threat to all unionism carried by that specific fear which, as stated in these columns last month*, has lately come to grip Big Boss Public himself—the fear of a civil war which threatens to destroy our American Way.

At this moment of writing, it looks as though this advice may have come too late to secure any great abatement of that threat. Last month's "labor mess" is the "labor chaos" of today. John Citizen now looks directly into the evil face of civil war as brought about by a general strike.. Altogether, John Citizen's fears appear justified.

A Dangerous Buzz Saw

Justified, also, is that fear for unionism itself which evidently prompted Murray's appeal for the yellow light of caution. His experience has taught him what younger leaders do not know—that the general strike, or anything resembling it, is a very dangerous buzz saw to fool with. Although aimed at employers, the general strike becomes at once a strike against the public—and for that reason is always a failure.

Today Phil Murray's advice may well be based upon exactly the same reasoning that makes many industrialists believe the only way to save competitive enterprise is to fight now the civil war that is likely to bring here the same result that followed Britain's nationwide walk-out in 1926—namely, the law of 1927 which limited labor's battles to economic, and the abandonment of political, methods and objectives.

At this writing it is impossible to foretell just what may be the result of this current month. It may later be known in history as the month of the "great industrial crisis." But it does appear likely that certain tragic consequences are now threatened in the field, if not of our political, then of our economic system. Witness the amazing fact that during the same time that the wheels of our world-famous machine of production and communications are threatened with stoppage by the biggest sprag ever inserted by conscious purpose in our history, at that same moment buyers on our stock exchanges have been offering higher prices for certificates conveying the ownership of exactly those same sprag-threatened wheels!

Why such an anomaly?

Can there be any other explanation than this—that to get out of its present jam without losing CIO's support, the government now feels compelled to favor certain price increases—to risk, that is, the well-being of every citizen by rubbing the Aladdin's lamp of inflation? It expects, of course, to stop its rubbing in time to prevent this lamp's harmless-looking but evil jinn from making the proffered wage increases worthless.

Why does using this lamp of inflation, always illusory and so often catastrophic, now strike the government as the only way to quiet John Public's fear of civil war?

I believe it is because, about ten years ago, it occurred to the leaders of government that, to maintain their party permanently in power, they need only arrange to gain the votes of the largest imaginable body of wage earners. Since, as stated in last month's article, the AFL leaders who were consulted proposed only an extension of the numerically small and limited trades unions, government deemed it better to promise its help to leaders equipped and willing to organize the much more numerous votes of the tradeless, unskilled, unorganized workers.

Due, doubtless, largely to the current depression, this historic governmental compact meant the promise of political support to, among others, many contingents who were much less interested in the "old-fashioned union business of winning more money for workers" than in "tinkering with the country's economic (and political) system." While these radicals never represented any great number, their allegiance to the sacred cause of revolution—their willingness to work day and night for it—has always enabled a mere handful to direct and control the action of their less subversive and less zealous fellow-unionists. In addition, these few have long had the benefit of training in the "mass strike strategy" worked out and agreed upon by the Communist Party at such conferences as that held some years ago in Strasburg.

"Walter Reuther is not a Communist," thus one who attended that meeting confirms the direction of Murray's eyes. "But his objectives are such as to enjoy the support of his union's leftists."

Cause for Bewilderment

Active partnership with this contingent of purposeful "tinkerers" could hardly have been foreseen by our government when it decided to abandon its position as impartial umpire and, instead, to trade its cooperation for the support, not of all wage earners and not of all unions, but only of those which by their nature could hope for almost unlimited membership. But that compact with its ensuing partnership does help to explain why the public as well as the employers have been so bewildered during recent years, and also why so many of our wage earners have been not only bewildered but also divided into so many opposing camps.

"For years," so an AFL leader lately put it, "any employer who bargained collectively with the CIO was in reality bargaining with his government! No wonder that such employers—to say nothing of AFL and of numberless independent and other worker groups—have considered this an unfair, unjust arrangement, certain, in time, to bring our country to its present impasse."

That same leader's long experience would have enabled him to point out to

* See "The Public Is Fed Up With the Union Mess," January, page 97.

WHITING WILLIAMS SAYS

- Last month's "labor mess" is the "labor chaos" of today
- To get out of its present jam without losing CIO's support, the government now feels compelled to favor certain price increases—to risk, that is, the well-being of every citizen by rubbing the Alladin's lamp of inflation
- Labor can evidently expect to continue for some time to bargain politically with government rather than collectively with employers
- Every inflationary race between wages and prices is lost not only by the wage earner but by everybody else
- No law can ever take the place of job takers and job givers who look into one another's eyes across the table

any and all political leaders the crisis sure to ensue the moment they dare to refuse even the slightest demand made by the heads of workers formerly unorganized and therefore new to the implications of unionism. Even though such heads are granted 99.44 percent of their demands, the instant the last 56 hundredths is for any reason refused, they can save their face and their official position—also their membership—only by ordering a strike. This is not because such leaders are unreasonable. Instead, it is because the resultant battle, even if lost, serves to provide convincing demonstration of their loyalty to their followers.

In passing, it should be added that, according to many experienced labor leaders, the CIO has always neglected properly to "sell" its members on unionism and the "labor movement" as an historic ideal worth patience, and at least temporary suffering and sacrifice. On the contrary, it has put its reliance upon either its promises of immediate wage raises or upon its amazingly ingenious techniques of intimidation and social pressure—also, in far too many cases, upon the lawlessness permitted on local picket lines by politically committed state and federal as well as municipal governments.

If our political leaders had possessed greater experience, they would surely have foreseen the day when they would have either to break their compact with the head of "green" unionists or else lose the public's confidence and support. But even if this error were overlooked, it must be said that, especially during the war crisis, our government showed slight understanding of other and more obvious complexities in the field of labor relations.

Serious Mistake

For instance, while it set up such tools as the War Labor Board, it made the serious mistake of giving the board no set of principles on which to operate. Accordingly, that and related agencies first endeavored to handle each case "on its merits"—only to give later to every such decision the force of precedent and, to all intents and purposes, of law. Altogether, they proceeded seriously to disappoint workers, employers, and public with a conglomeration of wage stabilization, wage setting, mediation, fact finding, voluntary arbitration, political finagling, and, finally, virtually compulsory arbitration.

More pertinent, today's political leaders show slight understanding of the wide differences that separate the principles and techniques of conciliation, fact finding, and arbitration—just as they also fail to see that collective bargaining, in spite of all appeals for its peacetime return, simply cannot function as long as war or pre-war prices remain frozen.

Similarly, these political leaders have to date failed to convince Boss Public that wages can properly be based on past and prospective profits but kept from influencing costs and selling prices. Equally unconvincing, also, has been their effort to base every employee's purchasing power and every employer's wage rates less upon actual productivity than on the specific total national income of $160,000,000,000 which they believe (or guess) necessary if the country is to find it easy to pay the interest on its national debt.

All of which explains the anomaly of stock exchange tickers which turn faster in the expectation of higher prices while the wheels of reconversion face stoppage. It is because our political leaders were too inexperienced to foresee the day when they would have to choose between denying, on the one hand, their political partner's demand for at best uneconomic wage increases and at worst a change of our American system —or, on the other hand, risking the universal disasters of inflation.

The moment of writing, no one can predict the outcome of what now appears to be the government's wish to give to its fact finders the wartime powers of compulsory arbitrators and thus to undertake the enormous task of determining all peacetime wages and all peacetime prices.

From the industrialist's angle one outstanding point is that labor can evidently expect to continue for some time to bargain politically with government rather than collectively with employers. A second point is that, even though many large employers are now accused by their workers of every sin in the book, the real opposition to their demands for "purchasing power" without any reference to productivity, now comes less from Mr. Employer than from Mr. Man-on-the-Street. And from him it comes only because he has observed over the years that profit sharing supplies too fluctuating and too unreliable a base for "take-home," and that every inflationary race between wages and prices is lost not only by the wage earner but by everybody else.

Putting the Heat On

It is because John Public abhors such chaos as he now endures that he can be expected to put the heat on Congress for curbing, or at least for making more responsible, the country's politically created Frankenstein. It is fervently to be hoped that the results will be fair to job takers, job givers, and customers alike. That will, of course, require compromise. But "the arrangement of viable compromise"—not of unjust compact—is said by philosophers to be the specific expert function which justifies the politico and the legislator. Nevertheless, it has to be added that at best no law can ever take the place of job takers and job givers who, as intelligent, honest, and fair-minded men, look into one another's eyes across the table.

Perhaps, accordingly, the most that can be expected from Congress is that it will permit the building of a prosperous and happy reconverted America by helping to end its long-suffered political compact and return to the old-fashioned give-and-take compromises of constructive industrial relations.

Using Statistics to Control Mass-Production Quality

EUGENE GODDESS, Head of Factory Engineering, North American Philips Company
Dobbs Ferry, N. Y.

MASS PRODUCTION of any product introduces minute, unique variables which in their aggregate tend to cause the product to lose its uniformity to the point where those differences can cause industrial losses. This is true of radio tubes and consequently techniques used to control the quality of mass production are applicable.

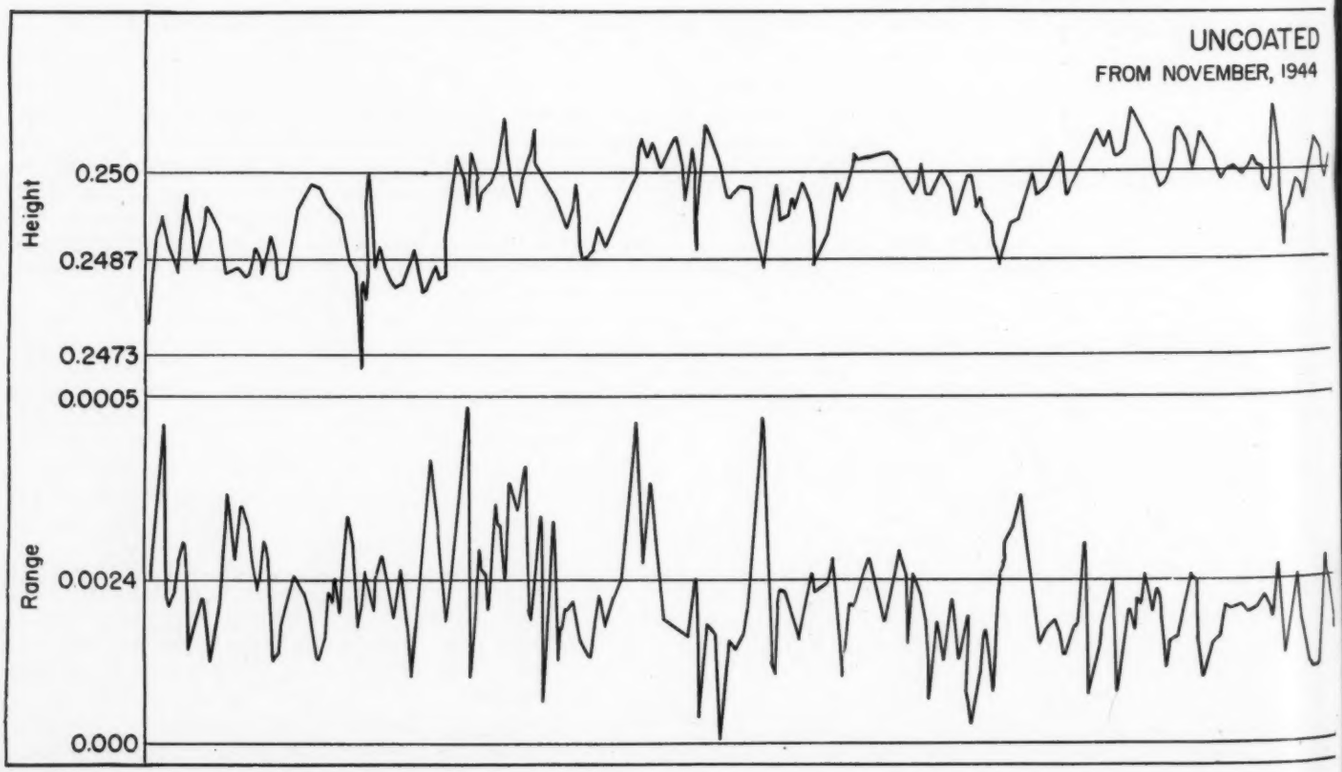
We shall describe in this article, how three structures were brought under control at North American Philips to the point where they became the least varying components in the cathode ray tubes in which they were used.

The cathode structure is composed of a cylinder of "radio" grade nickel, 0.250 inch of which is held above the cathode ceramic by means of a collar. The cathode is coated with a layer of mixed carbonates, radio grade, about 0.006 inch thick. The structure is shown in Figure 1. When placed inside the grid structure, as shown in Figure 2, the space between the top of the coating and the grid becomes of the order of 0.005 or 0.006 inch, a necessary construction because of the various electrical characteristics required by the tube specifications. Now it is easily seen that with such a construction, a 0.003-in. change in height dimension can readily become an industrial headache.

Since the over-all height of the coated cathode is determined by (1) the height of the cylinder above the collar, and (2) the thickness of the coating to control the cathode structure, both these factors should be observed. One might argue that only the coated cathode need be observed, but it should be pointed out that thin coating can result in poor life whereas an excessively thick coating can be difficult to degas and be an inefficient emitter, since the temperature gradient between the base metal and the cathode surface may be considerable. It is difficult to make accurate measurements of the thickness of the cathode coating. However, if the uncoated cathode height is brought under control, then the coating thickness can be assumed to be (on the average) the difference between the average value of the heights of the coated and uncoated cathodes.

What was done in this instance was to control both the uncoated and coated cathode heights, making measurements

Below, curve that resulted from 8 months of controlling uncoated cathodes. Range of 0.0024 inch was reduced to 0.0009 inch



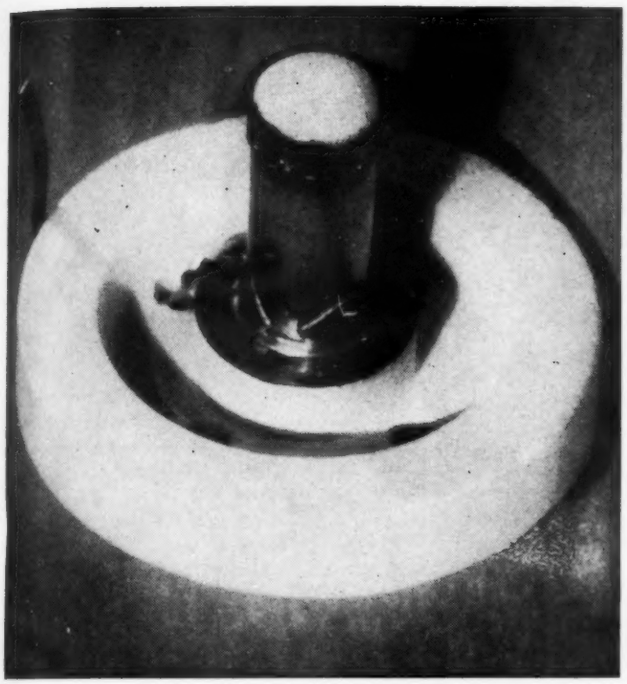


Figure 1. Cathode is a cylinder of "radio" grade nickle held above the cathode ceramic by a collar

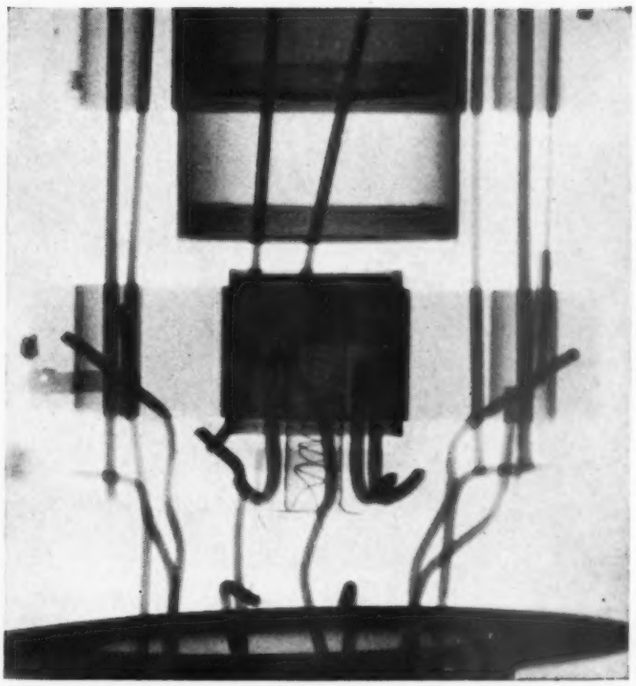
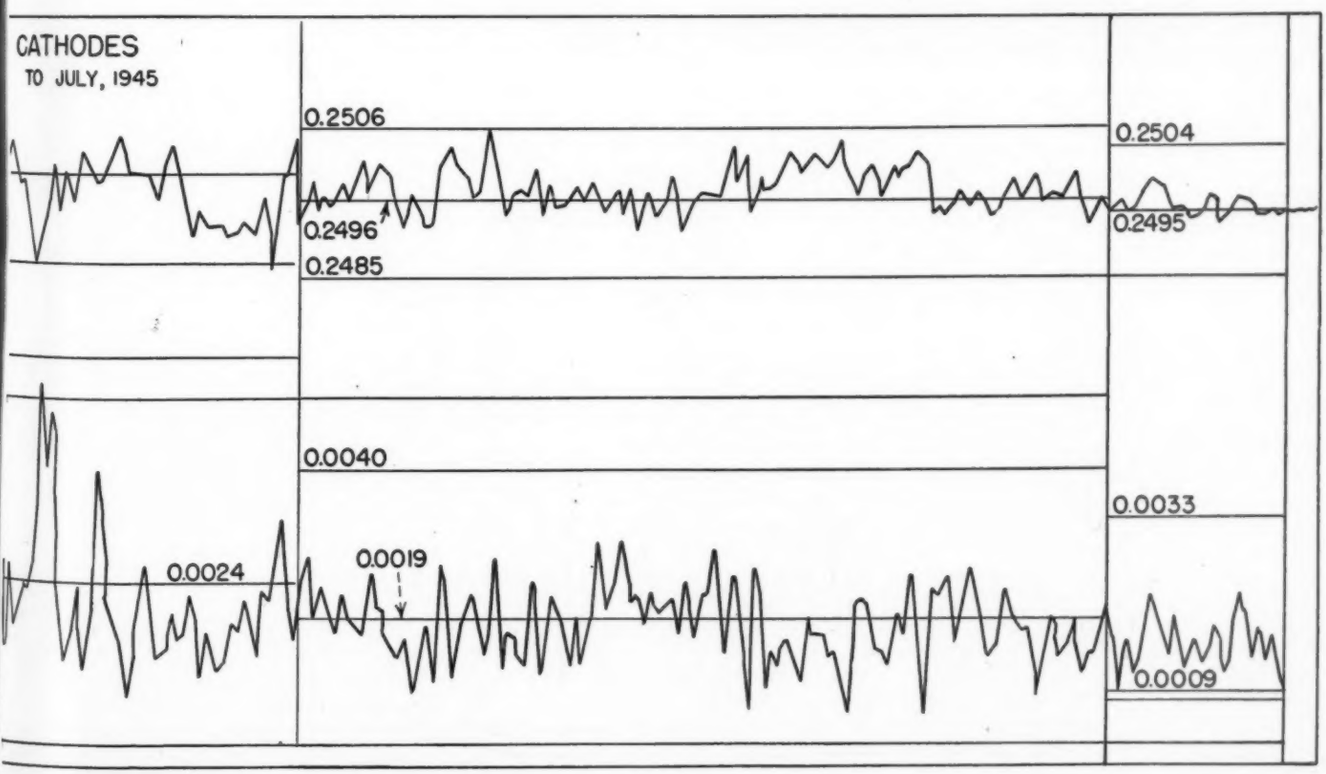


Figure 2. In the grid structure, space between top of coating and grid is 0.005 or 0.006 inch

by means of a toolmaker's microscope, shown in Figure 3.

A sample of five cathodes is taken periodically at random from production, and the dimension to be controlled is measured. The average value of the five readings is plotted as height. The difference between the largest and smallest values of the five observed measurements is computed, and this difference value is plotted as range.

The chart shows the control curve which resulted from 8 months of control on the uncoated cathode. One of the difficulties in conducting this control was that production was spasmodic—i.e., a crew of operators could produce enough cathodes in a 3-day period to cover about 10 days' tube production. Notwithstanding this difficulty, the mean value of the readings



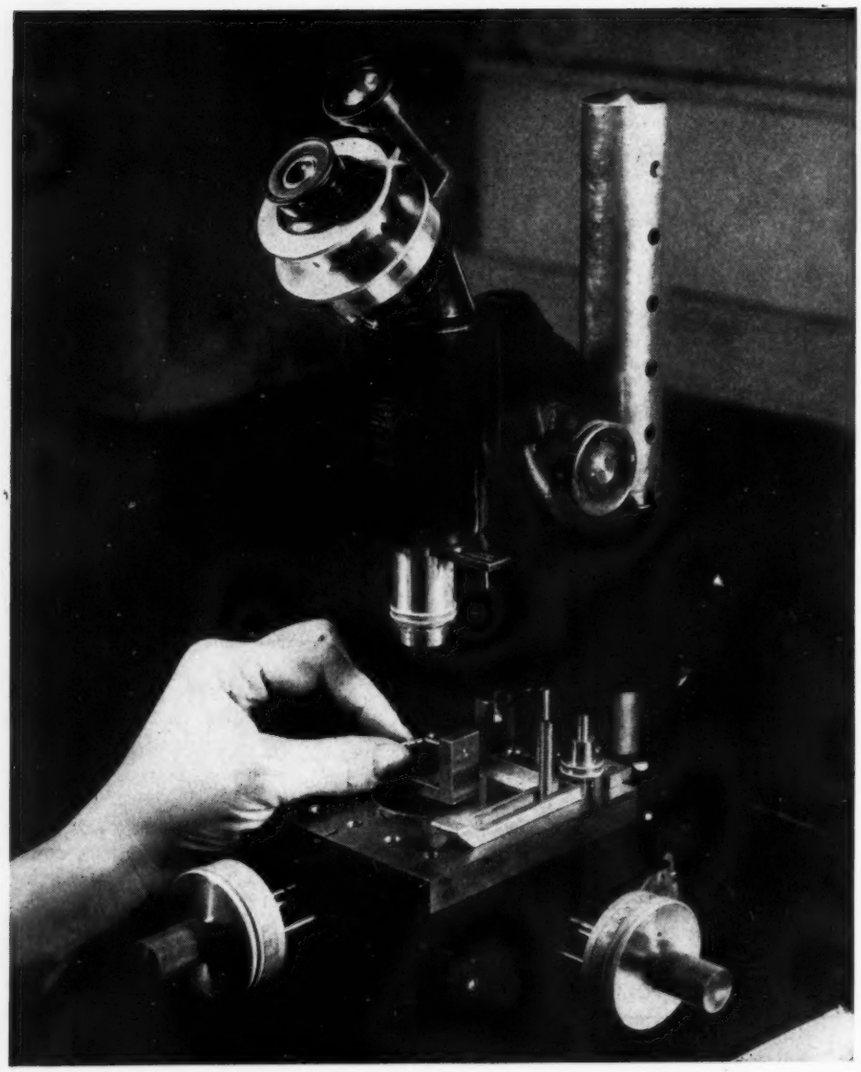


Figure 3. Measurements were made on a toolmaker's microscope

was brought to within 0.0005 inch of the mean of the specification. Prior to the institution of the control, the average of the readings was 0.0013 inch away from the mean of the specifications—and this in a case where the lower limit is presumably 0.001 inch away from the mean.

At the initiation of the control, an average range of 0.0024 inch was computed, whereas at the end of the 8-month period the value was reduced to 0.0009 inch. Certainly this control was worth the effort.

The control on the coated cathode showed excellent results mainly because various methods of reducing the coating height were tried. The statistical control enabled rapid and meaningful interpretation of the results.

The heater is a double helical coil made of tungsten wire and coated with pure alundum. Since the heater current is set at a specific value, it is necessary to maintain the heater resistance within certain limits. The heaters are prepared by cutting various lengths of wire, depending on the weight per 200 millimeters of wire, and then winding the wire into a double helix. The helix is then coated and finally baked in a hydrogen furnace, thereby sintering the alundum coating to the heater.

Two problems are presented by this structure. The first is obtaining the proper heater current, and the second is obtaining the proper amount of alundum coating, thereby reducing cathode-to-heater leakage and shorts.

Measurement showed that the lead resistance was of the order of 0.06 ohm so that as a matter of specification it was decided that a cold wire resistance between 1.30 and 1.40 ohm would maintain the current between the specified limits.

With this information at hand, control was initiated. It was shown that (1) the heater wire on the spools was not of uniform diameter for the entire winding on the spool; (2) more accurate methods of length cutting were needed.

The wire resistance was measured by means of a special wheatstone bridge. A sample of five heaters was taken every hour during the period when wire cutting was in operation. The average value was plotted as resistance and the difference between the highest and lowest values was plotted as range.

A control chart of heater resistance was plotted over a period of 9 months. Initially the product was far away from the desired mean of 1.35 ohm. As improved methods of cutting and engineering devices were introduced, the statistical control became tighter. In all cases, the measure of the efficacy of a new technique was the control chart. At the end of the 9-month period the resistance varied about 0.004 ohm from the mean and the range was reduced from 0.078 to 0.022 ohm maximum.

Weight Control Chart

A heater coating weight control chart also was made. Experiment showed the desirable heater coating weight to be about 10 to 12 milligrams. Initially, the amount of coating was determined by operator inspection. When the control chart got under way, it became immediately apparent that an automatic timer would be required to lend a suitable degree of uniformity to the product. Since this was a self-cycling timer, there was a tendency for the operator to miss the start of the cycle by about half a second.

Then a foot pedal control timer was introduced. The operator placed the heater in the alundum suspension, stepped on the pedal and the cataphoresis began.

Much difficulty was encountered at first because of operation inexperience, varying line voltage, and instances where the balance used for weighing was improperly adjusted. When those explicable readings were discounted and new limits computed, the mean of the limits, 11.3, was almost coincident with the specified mean. The upper and lower limits were 11.7 and 10.9 milligrams, respectively. These limits were instituted and retained for the duration of the chart. It was interesting to note that when the timer stopped keeping proper time, the control chart indicated it immediately. Production was then suspended until a new timer was installed.

The use of statistical control charts is applicable to some vacuum tube manufacturing problems. These charts of themselves do not control a product but they do supply a useful measuring test by which the control can be observed.

Procedure for a Successful Suggestion System

W. E. GROTH

Suggestion System Manager, Johnson & Johnson, New Brunswick, N. J.

One "must" in any successful suggestion plan is a booklet for employees that explains how the system works. Companies now contemplating such a booklet will find it profitable to examine pages from Johnson & Johnson's "What Do YOU Suggest?"—some of which are reproduced full size with this article

AN EMPLOYEE SUGGESTION SYSTEM, as conceived and operated at Johnson & Johnson, is a definite procedure (1) for soliciting, classifying, and appraising ideas from employees that may benefit the company in its operations or in its relations with its employees, its patrons, or the public, and (2) for rewarding employees who submit such worthwhile ideas, generally with a cash award.

He got a check for $1179 for suggesting a better method of opening and salvaging cartons! It saved the company $7860. Awards at Johnson & Johnson are customarily made by foremen, but this one called for a little ceremony involving the vice-president in charge of manufacturing

Back of the plan is the basic idea that the man on the job is the logical person to suggest better ways for doing his work. If he feels that his importance as an individual is recognized, and that his ideas will be fairly considered, he will do his work more efficiently and with greater enthusiasm.

The principal objectives of the J&J employee suggestion system are therefore (1) to encourage and stimulate the flow of constructive suggestions that may improve working conditions and methods; (2) to bring about better relations between management and employees through the establishment of a common meeting ground for discussion of ideas and thoughts about the company and its work; and (3) to direct the eyes, ears, and minds of all employees and officers toward bettering the work of the company.

To make sure that workers understand the thinking back of the plan, the company has combined in an attractive booklet (4x7 inches) all the rules it feels may be needed to run a successful suggestion system. It has been J&J experience, in passing, that the simpler the system, the better its chance of success.

Pages from this booklet are reproduced herewith in the thought that the booklet may be used pretty much "as is" or in slightly modified form by other companies that are planning to set up suggestion systems, or that wish to improve systems now in use. Not included in the illustrations for this article is the following definition which is displayed on page 4 of the booklet:

"A suggestion is a positive, constructive idea to improve methods, equipment, and procedures; to make for safer and better working conditions; to reduce the time or cost of an office, factory, or sales operation; or to improve either industrial or public relations."

The following suggestion system out-

"Make your ideas hatch dollars," says Johnson & Johnson in the suggestion system booklet it distributes to employees. Suggestion boxes, placed in 43 plant locations, serve as reminders to workers that, as Charles F. Kettering has said, "the whole fun of living is in trying to make something better"

line is from Johnson & Johnson's Standard Personnel Practice No. 8:

Purpose

The object of the suggestion system is to solicit and investigate all employee suggestions with an eye toward the improvement of existing methods, and products, the reduction of waste, and the cementing of employee and employer relations.

The suggestion system does not have the authority to approve or disapprove suggestions made by employees, but assists and advises supervisors in the soliciting and investigation of all suggestions. It is a service department and, in the final analysis, the supervisor is entirely responsible for the number and quality of suggestions received from his department.

The administration of the suggestion system is under the direct supervision of the suggestion system manager, who is responsible to the personnel director. All questions pertaining to suggestions and not answerable from available information should be referred to the suggestion system. All suggestions received should be immediately turned over to the suggestion system for investigation, regardless of how important or unimportant they appear to a supervisor.

Eligibility for Making a Suggestion

All employees and supervisors below the classification of foreman are eligible for cash awards except staff and service employees whose regular duties lie in the line of creative work. Not eligible for cash awards are engineers, chemists cost, time study men, etc. However, the compensation and advancement of such employees in the organization are importantly influenced by their ability and initiative shown in making worthwhile suggestions.

Preparing the Suggestion

1. *Obtaining the blanks.* A suggestion should be made on the Employee Suggestion Form No. 33-13 which is supplied the department head by the label room. Suggestion boxes have been supplied in all departments. It is the supervisor's duty to see that suggestion blanks are always available in the boxes.

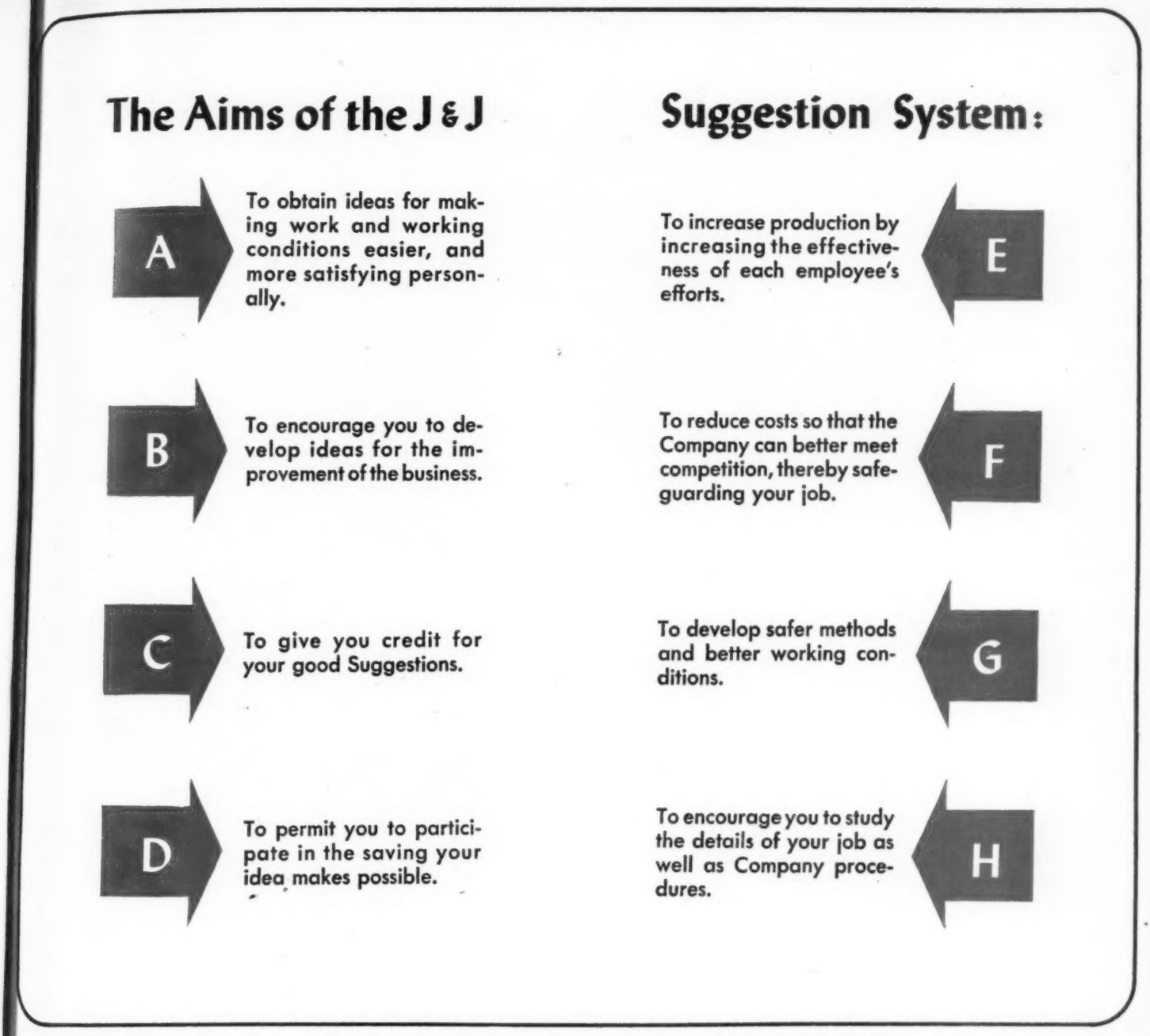
2. *Writing the suggestion.* An employee may expect assistance from anyone of his superiors or from a member of the suggestion system. This assistance extends to help in writing the idea, in making it clear, specific, and concise.

3. *Delivering the suggestion.* The label room carries a supply of envelopes addressed to the suggestion system. These may be obtained by foremen and given to employees or kept in suggestion boxes. Employees may turn in suggestions through the regular interdepartmental mail service. Suggestions may also be mailed outside through the U. S. mail, may be sent to the suggestion system directly by the supervisor in charge, or may be personnally delivered to the suggestion system by the writer, the latter only when it does not interfere with the employee's duties.

Booklet distributed to all men and women tells (1) aims of J & J suggestion system, (2) who can make a suggestion, (3) types of suggestions desired, (4) how to submit a suggestion, (5) what happens when a suggestion is received, (6) how suggester benefits. Full-size reproduction of these sections are shown on facing and subsequent pages

Investigating the Suggestion

When a suggestion is received by the suggestion system, it is assigned a number, recorded, and checked for duplication. A letter of acknowledgment is then mailed to the suggester, and as soon as possible thereafter an investigator will visit the suggester, his supervisor, and all others who can contribute to the investigation.


The Aims of the J & J Suggestion System:
A
To obtain ideas for making work and working conditions easier, and more satisfying personally.
B
To encourage you to develop ideas for the improvement of the business.
C
To give you credit for your good Suggestions.
D
To permit you to participate in the saving your idea makes possible.
E
To increase production by increasing the effectiveness of each employee's efforts.
F
To reduce costs so that the Company can better meet competition, thereby safeguarding your job.
G
To develop safer methods and better working conditions.
H
To encourage you to study the details of your job as well as Company procedures.

Booklet sets down "in words of one syllable" eight why's of the suggestion system. The why's make it perfectly clear to the rank-and-file employee that both worker and company stand to win

The suggestion investigator gathers all the necessary data, including sales information, installation, new tools, machines, new material, changes, etc. These he presents to the foreman showing, if possible, savings involved. Certain suggestions of an intangible nature involving comfort, fatigue, rest, safety, morale, or attitude of employees are referred to the personnel department.

Accepting and Instituting Suggestions

The investigator combines the idea of the employee with additional suggestions from the foremen and other interested parties, and arrives at the best solution to any problem. The foreman then issues the necessary mechanical orders or other orders for the change as set forth in the suggestion. This procedure indicates that the suggestion has been accepted.

After the suggestion has been thoroughly investigated and installed, and the cost as well as the savings of the proposed changes have been figured, the foreman, the product director, or other interested party confirms the amount of savings.

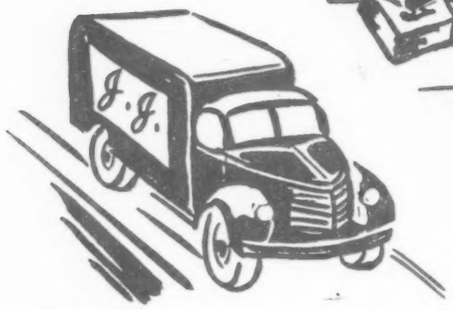
Determining Amount of Benefits

1. *Tangible suggestions.* For improvements resulting in measurable savings, cash awards based on 15 percent of the *estimated* net savings for one year, for direct operators, or 11¼ percent of the *estimated* net savings for assistant foremen, group leaders, quality control workers, mechanics, clerks, and others in supervisory capacities below the rank of foreman will be paid. Minimum cash award is $5. There is no limit to the amount that may be paid. The net savings are figured on the basis of the previous 12 months' sales, minus ⅓ the cost of the installation.

2. *Intangible suggestions.* Awards for improvements which do not result in measurable savings are based on the importance of the idea. The award will

—WHO can make a Suggestion —?

All employees and supervisors below the classification of Foreman are eligible for cash awards except staff and service employees whose regular duties lie in the line of creative work. Not eligible for cash awards are Engineers, Chemists, Cost, Time Study Men, etc. The ability to criticize constructively and the initiative to make worthwhile suggestions is expected of such employees and is recognized both in their advancement and compensation. The compensation and advancement of such employees in the organization are importantly influenced by their ability and initiative shown in making worthwhile suggestions.



Pages 8 and 9 of "What Do YOU Suggest?" tell who is eligible and who isn't. Note statement that compensation and advancement of other employees is influenced by initiative shown in making suggestions

be recommended by the supervisor of the department, assisted and advised by the suggestion system.

Payment of the Award

When the change is actually made and in operation, the award recommendation is sent to the vice-president in charge of manufacturing for final approval. If the award amounts to over $100, a copy of the accepted suggestion with all supporting data also is sent to him.

When the final approval is received by the suggestion system, a payroll check requisition is made out in the suggestion system office and sent to the payroll department, where the check is made out.

Upon receiving the check from the payroll department, the suggestion system writes letter explaining to the employee for what he is being paid, and check and letter are forwarded to the foreman for distribution.

Potential Value Suggestion

If management feels that a suggestion has potential value but, because of business conditions, is unable to adopt the suggestion at the time it is submitted, a token award will be paid, and the suggestion will be held in the "long range" file and reinvestigated periodically until such time as it is either accepted and any additional award paid, or the suggestion is rejected.

Rejection of Suggestions

In the case a foreman, superintendent, product director, or rejecting authority rejects a suggestion, he will submit a written rejection notice to the suggestion investigator. The employee receives immediately from the suggestion system a letter stating clearly the reasons given by the supervisor for such a rejection. This reason comes from the rejecting authority, and it will be based on data supplied by costs, methods, time study, engineering, per-

Types of Suggestions Desired

Your job offers you the best opportunity to make Suggestions. A detailed knowledge of your work and your experience combined with creative imagination, provide ideal conditions under which to develop worthwhile improvements.

You are requested to submit all Suggestions you consider of value to the Company, no matter how small the savings might appear to be. Suggestions should be carefully thought through and developed in as much detail as possible. All Suggestions will be thoroughly investigated.

Suggestions may be submitted on any subject pertaining to Company business, such as:

- **Accident Prevention**
- **Elimination of Fatigue**
- **Manufacturing and Operating Improvements**

- **Better Handling and Storage Methods**
- **Elimination of Unnecessary Work**
- **Employee Comfort and Welfare**
- **Reduction of Waste**
- **Reduction of Cost**
- **Improvement in Packaging, Containers, or Closures**
- **Improvement in Equipment and Tools**
- **Fire Prevention**
- **Improved Methods of Distribution**
- **Transportation Improvements**
- **Better Methods of Merchandising Products**
- **Sales Promotion Suggestions**
- **Better Service to Customers**
- **Improved Office Methods and Systems**
- **Product Improvement**
- **New Product Ideas**
- **Improved Housekeeping**

Suggestions dealing with improvements on parts, processes, or layouts which are projects of our Engineering or other departments will not be eligible for award until such time as the new improvement is considered complete. Should you submit a Suggestion on such an improvement, your Suggestion will be returned to you with information as to the approximate date on which the Engineering Department will have completed their work, at which time you may again submit it.

These two pages point out to the employee that his job offers him the best opportunity to make suggestions for worth-while improvements, that all ideas should be submitted, no matter how small the savings

sonnel, etc. In the case of duplication, the employee will receive immediately a letter stating that his suggestion is a duplicate and explaining what it is a duplication of.

Reinstatement

An employee may reinstate any rejected suggestion within two years of the original date of writing, merely by securing from his supervisor or the suggestion system a reinstatement form, filling it out, and sending it to the suggestion system.

If any change is made by management which includes the idea of any previously rejected suggestion, the original suggester will be paid an award in the usual manner, as long as the suggestion is not more than two years old.

Suggestion on Projects in Process

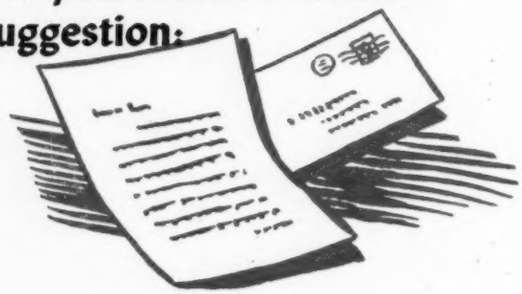
Suggestions dealing with improvements on parts, processes, or layouts being made by engineering or other departments, will not be eligible for awards until such time as the work in progress is considered completely installed. Should an employee submit a suggestion on the improvement of a process being installed, his suggestion will be returned to him with information as to the approximate date on which the engineering department will have completed its work. Then the employee may again submit his plan.

Suggestion Accepted

1. Signature of accepting authority secured.
2. Savings, if any, calculated by the investigator.
3. To suggestion system manager.
4. Inspected to see that figures are correct and as to handlings.
5. To system secretary.
6. Check off assignment books.
7. Remove active card from tickler file, record disposal, and file in month's completed accepted suggestions.

CONTINUED ON NEXT PAGE

Here is what you should do if you wish to submit a suggestion:



(a) Obtain a Suggestion form and envelope from the Suggestion Box in your department.
(b) Submit only one Suggestion on a form, be sure to date it and give your employee number and also your department.
(c) Tell what your Suggestion may accomplish and why you think it is a good idea.
(d) Tell location or department affected, material product or routines involved. Give machine name and number.
(e) Make simple drawings, jigs or samples if they will help.
(f) A Suggestion, to be accepted for investigation, must tell how an improvement can be made. Your proposed change may be improved upon by one of our Development Departments in which case you will be paid 50% of the award.
(g) If you need help in setting your Suggestion down on paper, approach your supervisor or anyone from the Suggesiton System.
(h) Place it in the Company mail basket, U. S. Mail, or bring it to the Suggestion System Office. If you feel that your Suggestion should be given immediate attention, give a copy also to your supervisor who will help follow it through.

Here is what will happen when your suggestion is received:

(a) Your Suggestion will be recorded, a letter of acknowledgment sent to you, and thoroughly investigated.
(b) In investigating your Suggestion the investigator will seek the opinions of all those best qualified to judge the merits of your Suggestion.
(c) If for one reason or another your Suggestion is rejected, you will receive a complete and satisfactory explanation as to why it was rejected.
(d) The Suggestion System will see that your Suggestion if adopted, is put into operation as soon as possible after it has been approved.

On page 12 of "What Do YOU Suggest?" the employee finds instructions for submitting a cost-saving idea. And on page 13 he learns what happens to his suggestion—something he really wants to know

8. Hold cards for monthly reports.

9. Copy of award requests sent to plant manager for approval.

10. Write check requisitions (personnel director to payroll).

11. Checks returned to suggestion system secretary for distribution.

12. Write letter to suggester describing suggestion being paid for, and attach check and new suggestion form (copy to suggester's folder and file).

13. Distribute check and letter to foreman who in turn personally distributes to suggester.

14. File suggestion.

Flow of Suggestion

Following is the flow of an employee suggestion from the time it is written to the time it is completed and filed:

1. Suggester writes suggestion.

2. Suggester mails suggestion.

3. Suggestion is delivered by mail department to suggestion system office.

4. It is received and dated by suggestion system manager.

5. Edited, titled for subject file, marked to indicate foreman and department affected, and date received.

6. Suggestions are held in group until following morning.

7. Suggestion goes to suggestion system secretary.

8. Check number assignment sheet for number and credit department from which suggestion is received.

9. Assign number to suggestion.

10. Fill in investigation sheet.

11. Write acknowledgment letter. (Original to suggester; copies to department head affected and files.)

12. Type numerical, name, and subject file cards.

13. File numerical and subject cards.

14. Attach name card to suggestion.

How you will benefit—

(a) For improvements resulting in measurable savings, cash awards will be paid based on 15% of the estimated net savings for direct and indirect operators, clerks and secretaries; or 11¼% of the estimated net savings for Assistant Foremen, Group Leaders, Quality Control Inspectors and Mechanics. Net Savings are figured on the basis of the previous twelve months sales, minus ⅓ of the cost of installation.

Installation Cost is the amount of money required to put your idea into effect. This is written off on a three-year basis, so that only ⅓ of the investment cost is charged against the one year's savings.

Example: If you make a Suggestion which, it is estimated, will save the Company $500 in labor and material, and it cost $150 to install this improvement, the award for direct and indirect opergtors, clerks and secretaries will be

$$\$500 \text{ Minus } \frac{\$150}{3} \times 15\% \text{ or } \$67.50$$

Using this same example, the award for Quality Control Inspectors, Mechanics, Group Leaders, and Assistant Foremen will be

$$\$500 \text{ Minus } \frac{\$150}{3} \times 11\frac{1}{4}\% \text{ or } \$50.63$$

(b) Awards for improvements which do not result in tangible savings are based upon the importance of the idea. The award will be recommended by the head of the department affected since he, better than anyone else, can measure its value. The award recommended by him will be reviewed by the Suggestion System.

(c) The minimum cash award for improvements accepted and installed is $5.00. There is no limit to the award you might earn.

(d) A record of all your adopted Suggestions will be filed in your personnel folder. These may help you better your position in the organization.

(e) If Management feels that a Suggestion has potential value, but because of business conditions or other conditions beyond its control, is unable to adopt the Suggestion at the time it is submitted, a token award will be paid and the Suggestion will be held in our long range file and reinvestigated periodically until such time as it is either accepted and any additional award due is paid, or the Suggestion is rejected.

No need for higher mathematics here! A worker with grammar school education can make the very simple calculation necessary. Note the punch line: "There is no limit to the award you might earn"

15. Check suggestion against file for duplication.

16. If duplicate, note is made on suggestion and suggester is advised (by letter).

17. Suggestion held till following morning.

18. Suggestion to system manager.

19. Manager inspects and decides which investigator can best handle it.

20. Assigned to investigator. (a) Name card marked as to who assigned to and given to secretary; (b) secretary files card in active file and lists in assignment book.

21. Suggestion investigated. (A status letter is mailed each suggester, each 30 days.)

Suggestion Rejected

1. Signature and written rejection received from rejecting authority.
2. To suggestion system manager.
3. Inspected as to handling.
4. Dictate rejection letter to the suggester.
5. To system secretary.
6. Check off assignment book.
7. Remove active card from tickler file, record what disposal has been made, and file in monthly completed rejected suggestions.
8. Hold cards for monthly reports.
9. File suggestion.

Suggestion Duplicated

1. Reason for duplication listed.
2. To suggestion system manager.
3. Inspected as to handling.
4. Dictate duplication letter to the suggester.
5. To system secretary.
6. Check off assignment book.
7. Remove active name card from tickler file, record disposal made, and

General Information

(a) All applicable deductions required by law such as income tax, etc., will be made when the award is paid.

(b) Suggestions which are believed to be original thoughts but may have been submitted previously by someone else, or may have been under consideration by management will be rejected as duplicates.

(c) Suggestions regarding obvious maintenance repairs or concerning a routine function will not be eligible for awards unless they show a new and improved method of doing the work.

(d) An employee's Suggestion which was not adopted when first investigated, but which is adopted by the Company within two (2) years from the date the proposal was first received by the Suggestion System, will be awarded if the Suggester will write to the Suggestion System referring to his original Suggestion which is kept on record.

(e) All Suggestions submitted become the property of the Company.

(f) *Any previously rejected suggestion, which is not more than two (2) years old, can be reinstated for re-investigation by written request to the Suggestion System explaining what the Suggestion was about, giving the number if possible, and additional information on which you base your request for reinstatement. (You may get a form for this purpose from anyone connected with the Suggestion System.)*

(g) In the case of a partnership Suggestion, the award will be evenly divided, unless requested otherwise in writing on the Suggestion form.

(h) If a change is made in any operation as a result of a verbal Suggestion to your department head, the Suggestion will be considered eligible for an award if you submit it on a regular Suggestion form within 30 days of the time the operation was changed, accompanied by a letter of approval from your department head.

(i) The Suggestion System decisions on any question relating to the interpretation or to the operation of the Suggestion System, or to the question of awards payable shall be final. The rules and policies of the Suggestion System may be altered or amended as such changes are considered advisable.

"What Do YOU Suggest?" concludes with two pages of general information about the J&J suggestion system and (not illustrated) an individual record of suggestions made—number, date, rejected, or accepted

file in monthly completed duplicate file.

8. Hold cards for monthly reports.

9. File suggestion.

Suggestion "Long Range"

1. Reason for long-range action.
2. To suggestion system manager.
3. Inspected as to handling.
4. To system secretary.
5. Check off assignment book.
6. Remove active name card from tickler file and record action taken. File in month's long-range file.
7. Copy of award requests sent to plant manager for approval.
8. Check requisition (personnel director to payroll).
9. Checks returned to suggestion system secretary for distribution.
10. Write letter to suggester explaining reason for placing in long-range file, and attach check and new suggestion form (copy to suggester's folder and file).
11. Distribute check and letter to foreman for distribution to suggester.
12. File suggestion.

Suggestion Monthly Reports

1. Manager takes physical inventory of all active suggestions.
2. Secretary gives completed cards for month to manager.
3. Manager and secretary complete monthly foremen's reports listing accepted suggestions–savings and awards for month by department (original to foremen; copies to bulletin, to training, plant manager, Chicago 2, and file).
4. Manager and secretary complete monthly summary report (copies to all foremen, superintendents, directors, Chicago 2, department heads, and file–45 copies).
5. All cards to secretary.
6. Secretary files cards, reports, etc., thus ending month's work.

Vision Tests Predict Worker Capability

N. FRANK STUMP, Industrial Vision Department, Bausch & Lomb Optical Company, Rochester, N. Y.

VISUAL TESTS were given to the workers in the electric soldering department of Bausch & Lomb Optical Company in order to determine (1) what visual functions are related to general efficiency on this job; (2) how visual functions affect amount and quality of production; (3) whether increased production is possible with equally high quality or better quality; (4) whether measurement of visual functions should supplement methods previously used at employment for selection and placement of electric soldering operators.

Some of the conclusions that can be made from the studies are:

1. An analysis of average hourly earnings and of rejects (caused by poor quality) showed that wide differences existed in employee ability to perform the job of electric soldering.

2. Average hourly earnings of employees who met visual standards were $0.827; those who had inefficient vision earned an average of $0.690. This difference of $0.137 in average hourly earnings means a difference of $1.096 per 8-hour day, or $6.576 a week. A weekly earning increase of $6.576 can be translated into an additional number of frames soldered with about 8 to 15 percent betterment in quality—quality being defined in terms of fewer rejects.

3. Application of test results to the study of various problems, such as absenteeism, has brought about positive results. For example, there were approximately 2½ times as many half-day absences among employees who had inefficient visual performance compared to workers who met the standards.

4. Had these visual standards been used originally in the selection of electric solderers, or had they been used to point out the desirability of rehabilitation of those not visually efficient for the job, an approximate 15 percent improvement in the work of A and B operators (A-very good; B-good; C-poor) should have resulted.

Electric spot soldering in frame department of Bausch & Lomb must be performed skillfully if finished product is to pass inspection. It has been proved that workers meeting visual standards produce more, therefore earn more, have fewer rejects, and have a better absenteeism record

The electric spot soldering process in the frame department of Bausch & Lomb Optical Company consists of joining metal parts by heating and then applying solder to the heated parts at the correct moment.

The surface to be welded is ground or filled, and flux is spread on the surface. Electrodes are closed, making contact with materials being soldered. In this process it is extremely important that specified heat be given to a small area, at which time solder is applied simultaneously until a sufficient amount has melted. The contacts are then released and the material is removed from the clamp.

Spectacles and parts worked on involve copper weld, nickel, gold-filled, and steel frames. Operators handle flux,

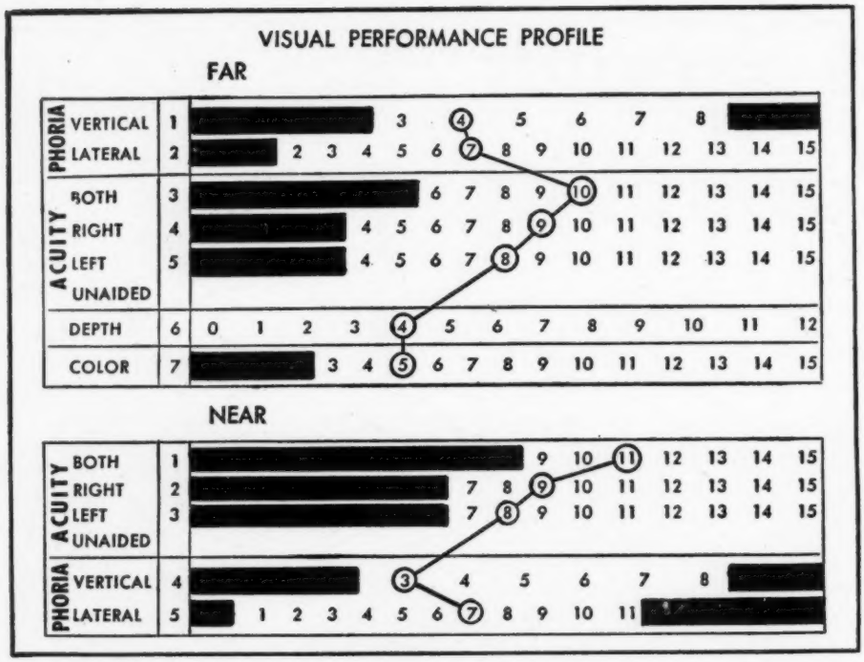


Figure 1. Visual patterns desirable for electric soldering operations, and the actual score made by one of the employees in the highest hourly rating group. Scores in the darkened area are undesirable

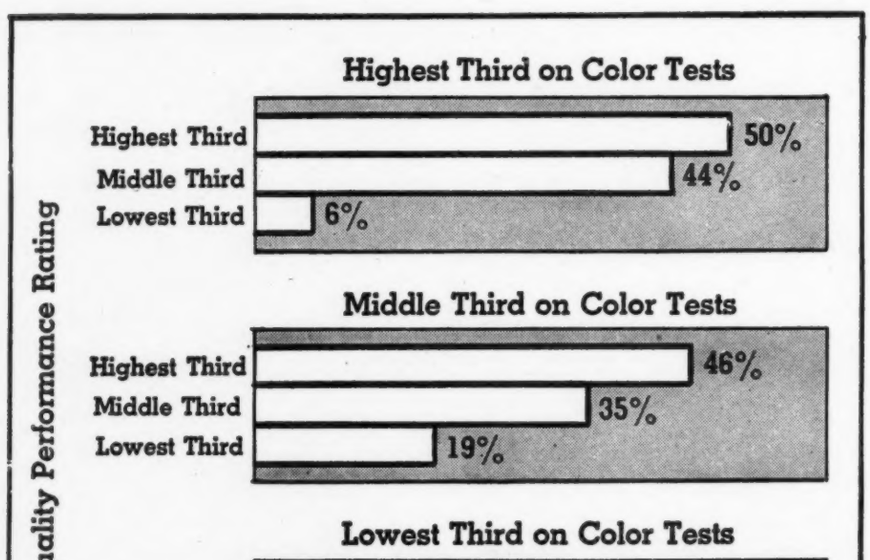


Figure 2. Comparison of quality performance and color discrimination. In the group of employees who rated highest in quality performance, 50 percent were also rated highest in color discrimination

brush, water for cleaning blocks, cotton gloves, file, nickel, 11-carat gold, and wire solder.

This job must be performed skillfully if the finished product is to pass exacting inspection. From a practical angle a rigid top arm and bridge assembly means accurate alignment of parts without the necessity for frequent adjustments after frames have been acquired by customers. This is extremely important to the persons wearing the frames, because the wearers of glasses do not have their frames adjusted voluntarily as frequently as is desirable. Eye-wear users, in general, do not realize that properly adjusted frames to fit the individual needs of the wearer are important if they are to see well and the frames are to look well.

The studies attempted to discover to what extent efficient visual functions improved not only the productivity of the employee, but also the quality of the work. It was argued that if a real relationship could be found between quality performance and visual functions, it would be to the advantage of the company, as well as to the employees, to see that the job was adapted to the visual characteristics of the operator. Experience has proved this argument to be correct.

It was found that this job calls not only for definite levels of visual acuity, but also for certain other visual skills relative to eye posture and color discrimination.

Each of the scores on all 12 tests was related to various degrees of performance on the job, in terms of criteria of success. These criteria of proficiency were:

1. Production figures.
2. Quality (percentage of spectacle frames passing inspection).
3. Average hourly earnings.
4. Performance ratings of foremen.

After all these criteria were applied, each visual function found important to this job was listed:

1. Acuity—both eyes—right and left eye separately, at both "far" (26 feet) and "near" (18 inches) distances.
2. Muscle balance—vertical and lateral phoria—at both "far" and "near" distances.
3. Color perception.

The desirable visual functions for this job fall outside the shaded area in Figure 1. This illustration not only gives the specific limits of visual skills, but also presents the specific scores made by one of the highest hourly earners. Other data, presented herewith, indicate a relationship between levels of average hourly earnings with percentages of those passing all these visual standards.

Separate visual tests have indicated some interesting results. Color perception was one of them. It might not be known precisely what this test actually measures, but taking a realistic point of view, it can be stated positively that whatever is being measured here, it has been found to have definite relationship with efficiency on many jobs.

As was stated above, it is necessary for operators to apply exactly the correct amount of solder and heat, since too much heat would result in crystallization of both stock and solder, causing breakage.

The determination of the correct amount of heat which has been applied can be judged by the color of the metal. This important phase in the whole process might account for the interesting results between employee efficiency and findings of the color discrimination test.

Of the employees who were rated highest in quality performance 50 percent were also rated highest in color discrimination. Only 6 percent of employees rated highest in quality performance were rated lowest in color perception (Figure 2). This indicates a definite trend in favor of efficient vision.

High Hourly Earnings

When color discrimination is compared with average hourly earnings (Figure 3), a similar trend is shown. Of the employees in the highest earnings group, 42 percent are also in the group with highest color discrimination. Only 17 percent of the highest earners are in the lowest group in color test discrimination.

Similarly, in the lowest earnings group, 41 percent of those with lowest earnings are also lowest in color discrimination. Only 27 percent of this group are in the highest group in color discrimination.

Experience shows that earnings increase among electrical solderers as there is an increase in scores on the near acuity test—both eyes. Since electric soldering is a piecework job, increased earnings mean a consequent increase in production. The data in Figure 4 indicate that the percentage of employees earning 80 cents or more an hour increases as the near acuity scores increase.

The advantage of high near acuity scores is revealed when it is noted that there are 25 percent more employees earning 80 cents or more an hour with a score of 12 than with a visual score of 9.

Up to this point relationships have been pointed out between separate visual tests and criteria of proficiency or success on the job. Now some consideration will be given to the relationship of standards of visual requirements in the form of patterns of several tests for the job and criteria of success. By increasing the number of tests for each employee and using the entire pattern, relationships are increased in reliability and validity.

Figure 1 gives the pattern of standards required for this job which is being used in the Bausch & Lomb Optical Company employment office when selecting electric solderers. These standards are extremely conservative and may be regarded as minimum rather than ideal. Follow-up studies of correction are made constantly in this department, and results in the light of production, quality, and other important performance phases, are reviewed. For these reasons, the standards may be increased at a later time.

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Average hourly earnings of 60 cents were found for employees who failed to meet the pattern of visual skills in Figure 1. For employees who met the visual standards, the average hourly earnings were 80.7 cents. This 20 percent increase in average hourly earnings in favor of employees who meet standards is extremely important. This difference of $0.137 on average hourly earnings means an increase of $1.096 per day of 8 hours, or $6.576 a week, compared with the groups that were inefficient in visual functions.

After applicants have been tested on the Ortho-Rater, the employees below the visual standards for electric solderers are sent to the eye clinic where professional eye men proceed to give a clinical eye examination to the applicant. On the basis of this examination, recommendations are made concerning glasses. At the same time, prescriptions are prepared for safety goggles, provided the job requires them. The standards set for specific jobs form an important set of facts which are helpful in the eye clinic when correction has been found desirable. The recorded visual demands of each job for which standards are available, assist the clinic in formulation of the best possible correction on the basis of employee visual need. Thirty percent of the electric soldering employees were referred to the eye clinic for attention. Follow-up studies are now being made and results analyzed to determine the amount of improvement in production and quality that can be attributed to the correction.

Experience reveals that average hourly earnings increase among electric solderers as there is an increase in visual efficiency. Since this is piecework, there is a consequent increase in production among the higher-paid group. The highest hourly earnings are four times as great as the lowest hourly earnings, consequently it can be said that some work-

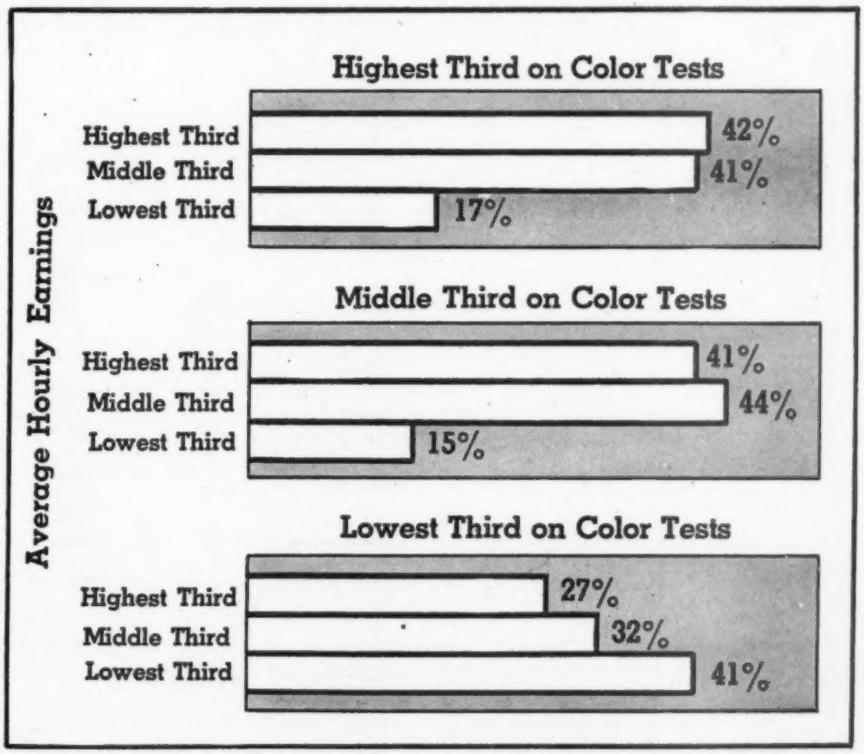


Figure 3. Comparison of average hourly earnings and color discrimination. Of the workers who had the highest hourly earnings, 42 percent were rated highest in color discrimination

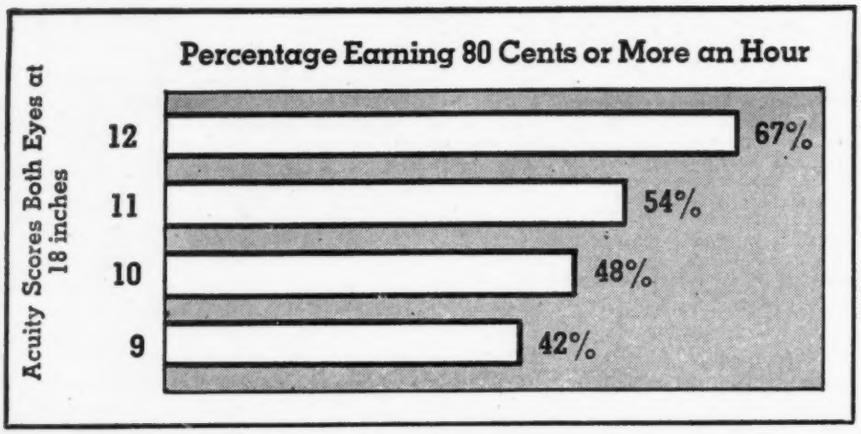


Figure 4. Comparison of scores for acuity—both eyes at 18-in. distance. As acuity for both eyes at 18 inches increases, the percentage of workers earning 80 cents an hour or more also increases

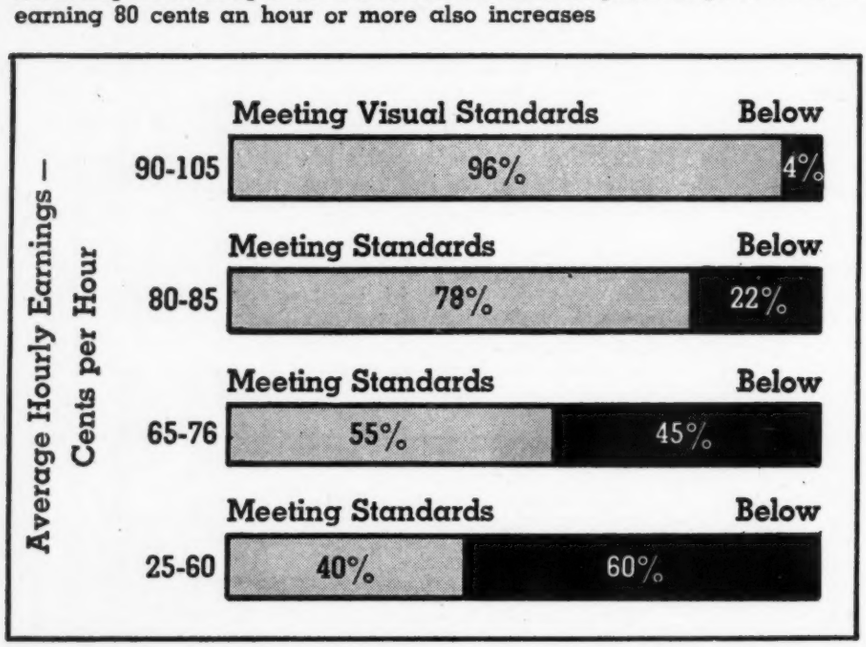


Figure 5. Comparison of average hourly earnings in cents per hour, and percentage meeting, and percentage below, visual standards. As hourly earnings increase, percentage meeting visual standards increases

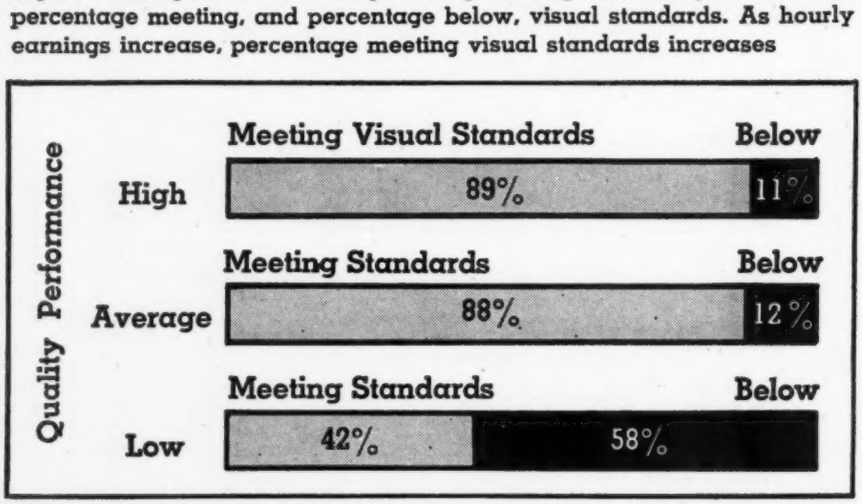


Figure 6. Comparison between quality performance rating and percentage meeting, and percentage below, visual standards. As quality performance ratings increase, percentage meeting standards increases

ers on this job produce in the same period of time four times as much as others. This is an extremely important difference in view of the fact that all operators studied have been on the job beyond the required training period.

More than 55 percent of the employees in the highest wage-bracket as compared to employees in the lowest wage bracket, are up to the visual standards set for electrical solders (Figure 5).

Foremen adjudged the quality of performance of these solderers. Of the group of employees who rated in the top group in quality, 89 percent met the visual standards. The group of employees adjudged in the middle group on quality had 88 percent in the efficient visual class. In the lowest group in quality only 40 percent met the standards. The facts are shown in Figure 6.

When the best group on adjudged quality is compared to the lowest group, there is an increase of 58 percent meeting visual standards among the high quality groups compared to the lower quality group. More than double the workers meet the visual standards in the high quality performance group compared to the lower performance group.

Absentee Record

A study was made in this same department to reveal the relationship between industrial vision patterns and the number of half-day absences. It was found that the inefficient visual group had 2½ times as many half-day absentees as did the efficient vision group.

The facts on absenteeism were obtained over a 13-week period. Employees who did not meet visual standards failed to report for work on an average of 28.6 half days. For the same period, employees who passed the standards had only 11.5 half-day absences. This difference of 17.1 half days is sufficiently great to be statistically significant. Thus another instance is recorded that the visually efficient group is made up of the steadier workers, and, by inference, may be regarded as the group that causes less employment turnover.

Testing employees in jobs in several scores of organizations has shown, consistently, a relationship between visual efficiency and job proficiency.

Fact-finding, relative to the place of visual functions in industrial jobs, has progressed far beyond the experimental phase. Numerous jobs have been subjected to rigorous investigation in different industrial organizations.

It has also been proved that when records of visual functions are available they can be applied with profit to accident prevention by setting up safety standards of vision.

Closer Control With Machine Load Board

G. KINGDON LOWE, Manager, Screw Machine Division, Grinnell Corp., Cranston, R. I.

PRODUCTION PLANNING that visualizes future loading prospects of individual machines and at the same time facilitates current performances of individual machines, is made simple, fast, and accurate in the screw machine division of Grinnell Corporation by the use of two large visual record boards and an accompanying record-keeping system.

Information on one board kept in the production control office duplicates the figures on the other board which is kept in a prominent position in the machine room. Since each board is 6 feet high and 8 feet long, there is ample space for 45 machines to be listed in a vertical column, and for the production schedules and records of each to be indicated on colored tapes extending horizontally across 93 vertical columns representing the days of three months. Each one-day column on the board is further divided vertically into four quarter-sections.

Previous Records Used

Production capacity of each machine is known from previous records, and it is therefore a simple matter to compute the number of days' production that should be scheduled for one or more machines on any given order. To visualize the production schedule, a transparent red tape of flexible plastic is pulled out from the left side of the board in the horizontal column beside the machine to be used. The tape is extended over the number of vertical columns that represent the number of days required by the estimate.

Thumbtacks bearing the order number are then inserted in the board to show the dates for scheduled start and finish. If additional orders for the same machines are received within the 90-day limit of the board, the thumbtacks for the previous order are left unmoved, but the red tape is pulled further to the right to show the additional period in which each machine will be used.

Meantime, as the daily reports of actual production covering each machine are received in the control office, a green tape is pulled from the left side of the board toward the right, to show how actual output compares with the

Operation Machine Item No.

PRODUCTION CONTROL ORDER
"MATERIAL RESERVE"

RELEASE NO. 2063

(Copy 1, Tool Crib — 2, Machine — 3, P. C. Tickler)

QUANTITY SCHEDULED STD. PC/HR.

	ALUMINUM BAR STOCK: SIZE	LBS.
	DURONZE BAR STOCK: SIZE	LBS.
	BRONZE BAR STOCK: SIZE	LBS.
	ALUMINUM FORGINGS: PCS. RELEASED	
	BRONZE FORGINGS: PCS. RELEASED	
	BRONZE CASTINGS: PCS. RELEASED	
	FROM 2ND OPERATION STORES: PCS.	

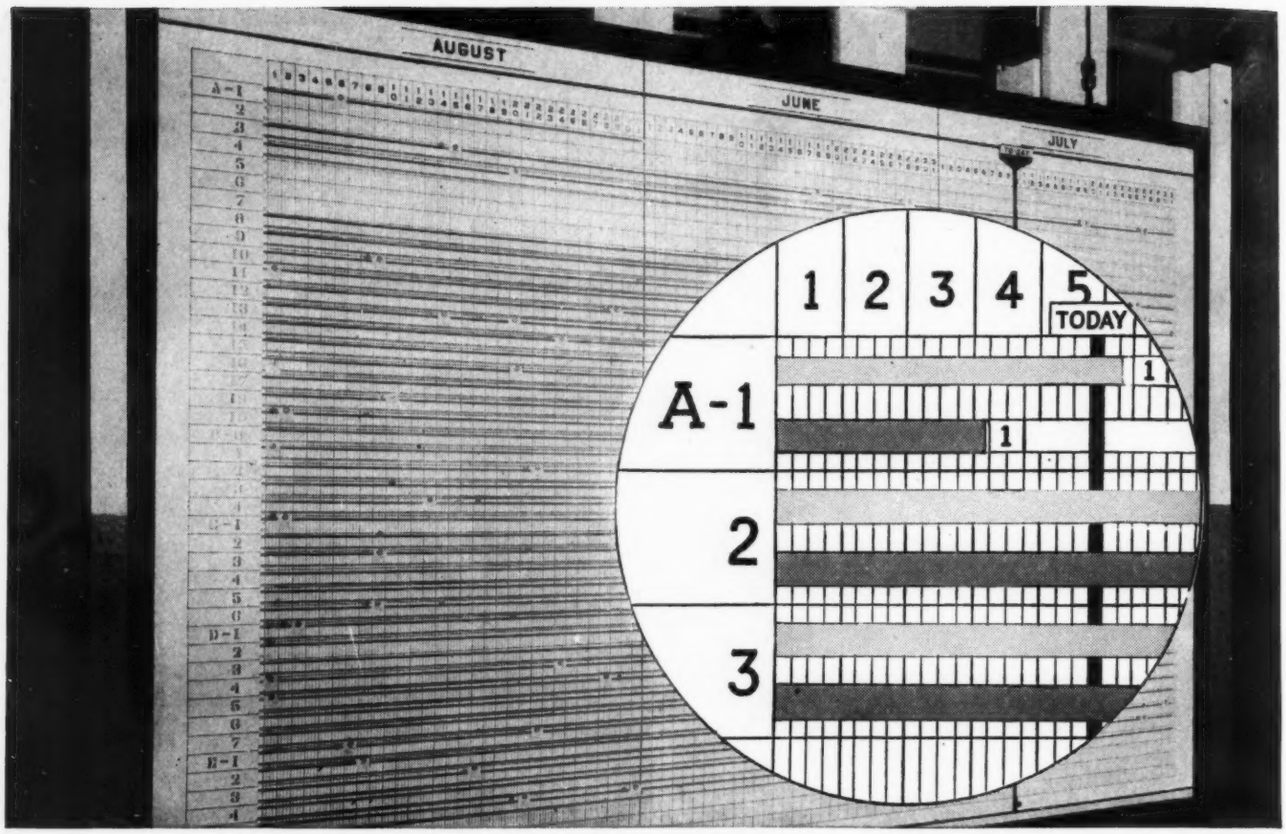
DO NOT TYPE BELOW THIS LINE

QUANTITY*					

TOTAL STOCK RELEASED

SIGNED BY TOOL CRIB SUPERVISOR: _____

Figure 1. Release tickets in triplicate are prepared by production control clerk as each new order for production is received. One copy is used to make a permanent record. Other copies go to toolroom and to machine room foreman. These include designation of machines to be used, quantity scheduled, date to start, and materials that will be required



Large size of production control boards at Grinnell Company provides plenty of space for easily visible details as shown here in inset. Number of days scheduled for each machine's use on any order is shown by red tape. Using same scale of measurement, actual output is shown by green tape

3 MANAGERIAL DAILY MACHINE AND EMPLOYEE EFFICIENCY

DEPT. No. 37 PRODUCTION DATA — DETAIL OF DOWNTIME

Mach. No.	Emp. Clock No.	Release No.	Item No.	Oper.	Actual Prod.	Hrs. On Prod.	Std. Prod.	% Eff.	Hrs. Down	Total Hrs.	% Down	No. Tools
Center 1												
A-1												
A-2												
A-3												
A-4												
A-5												
A-6												
A-7												
A-8												
A-9												
A-10												
A-17												
A-18												
A-19												
D-1												
D-2												
D-3												

2

Machine No.
Operator No.

Elapsed Time

Downtime Reason

Shift

Item No.

Check One
Direct Labor
Indirect Labor

1st Op.
2nd Op.
3rd Op.

Release No.
Date

Quantity
Piece

DRILLING & BURRING DEPT.
PRODUCTION & REPAIR CODE

A	B	C	D	E	F	G	H	K	L	M	I
Tap	Retap	Ream	Reream	Sand	File	Burr	Reburr	Chamfer	Re-chamfer	Misc.	No Tools

schedule. For example, if the daily schedule calls for 1000 units and the first day's output is only 750, the green tape is moved across only three of the four quarter-sections of a one-day column.

When an order is received by the control office calling for the production of a quantity of any item, the control clerk determines from his reference files or from the manager of the office what machine processes are required for the job. At the same time, he needs only to glance at the control board near his desk to ascertain which machines will be available and how soon they will be ready for the new work.

Release Ticket Issued

With this information the clerk makes out a release ticket in triplicate (Figure 1) showing which machines should be used, the date for production to start, the tools and materials required, and other details.

One copy goes to an office girl who copies the information on a card for a permanent record—because the records showing on the control boards are limited to its 90-day capacity. As soon as the copy has been made, the control clerk adjusts the red tapes on the board in the control office and also on the board in the machine room to show the adjusted schedule, and files the ticket in a tickler system.

The second copy of the ticket is sent to the toolroom, and the third copy is sent to the stockroom. The stockroom and the toolroom keep their tickets, face out, for visual reference until the time comes for the designated tools and materials to be sent to the machines. A record is then kept on their respective tickets of the tools and materials delivered.

Jobs Are Described

The next major step begins with listing the main description of each job on a separate time card for each machine (Figure 2). These cards are kept by a girl timekeeper seated at a desk in the center of the machine room, and at any time a machine is stopped or started on production the operator must notify the timekeeper. She rings in the time of the starts and stops on a printing clock, and at the same time marks a key number beside each stop to show what caused it.

These cards are available for study by the department superintendent, standards department, and production control office. But it is the showing of the green tapes on the big control boards that gives the chief warning signal of inadequate output, leading to intensive study of the cards.

Records of each machine's output are kept on other tickets clipped beside the machines, and verified by count and inspection. The output figures together with a summarized report (Figure 3) of downtime and its causes, for each machine, are sent to the control office every morning, covering the previous day's work. The production figures then are added to the previous cumulative total for each machine, and the combined total is immediately visualized on the control board by moving the green tape enough spaces to the right to correspond to the newest cumulative figures.

Thus the boards are up to date every morning, reflecting clearly the exact status of production of each machine and each class of item being produced. At the same time the boards show these facts in comparison to the schedule for each machine and for each item.

All Information on Board

On that basis a quick glance at the board is all that is needed to answer any inquiries from other departments regarding such matters as expected or revised dates for deliveries, or machine capacity for pending orders. Likewise, a glance at the board shows whether "all is going well" or whether certain machines are falling behind schedule. In the latter event, the comparison of the red and green tapes provides a warning signal for further investigation to find out what is wrong, and thus to lead to its correction.

The control board system and its related records have worked so efficiently in the screw machine department at Grinnell that the top management of the company has taken first steps to adopt a similar system in all production departments.

REPORT Date.....

DATA TO SHOW CAUSES

Wait Set-up	Actual Set-up	Tool Repair	Tool Sharpen	Tool Adjust.	No. Oper'rs.	Misc.

Standard Pc-Hr	Total Productive	Total Repair	Total Downtime
Hrs-C	Hrs.	Hrs.	Hrs.

Figure 2. Record of each machine's operations and downtime is kept on individual daily cards. Times and causes of stops are marked on cards by machine-room timekeeper. When low performance is reflected on main control boards, reference to individual cards quickly indicates the cause

AUTOMATIC & SEMI-AUTOMATIC MACHINE DOWNTIME & ALLOWED TIME CODE

2	3	4	5	6	7	8	9	10
No Material	Waiting Set-up	Actual Set-up	Tool Repair	Tool Sharp'ng	Tool Adjust'ng	Repairing Machine	No Operator	Misc.

Figure 3. Total of each machine's production, a comparison with standard output, and a summary of downtime and causes are reported daily to the production control clerk for examination, and for posting of production figures on main control boards

Navy and Industry Help Amputees Back to Work

How industry can cooperate with the armed services in the rehabilitation of wounded veterans, is well illustrated by the program now in active operation at the U. S. Naval Hospital, Mare Island, Calif. Here a practical plan has been worked out whereby amputees at the hospital are not only provided with educational and vocational counseling within the hospital, but are also given schooling and employment off the hospital compound.

Ordinarily, rehabilitation consists of two types of activity. One type includes such convalescent programs as occupational therapy and physical reconditioning, which take place within the hospital walls. The other consists of training or retraining after the man has been discharged from the hospital. In the case of the dischargee, this is a concern of the Veterans Administration.

Although a well-integrated program of the intramural type is standard procedure in naval hospitals, the educational services office at Mare Island found the need for a third type of rehabilitation, to bridge the gap between the other two phases. This third phase of rehabilitational activity, consisting of schooling or employment off the hospital compound, has the further purpose of coordinating and supplementing the other two types of rehabilitation. It has been particularly valuable in the case of long-term hospital patients, such as amputees, who constitute the majority of the orthopedic patients at Mare Island.

When this hospital first established its department of educational services, during the early phase of expansion of the Navy's program of rehabilitation, its first assignment was to provide educational and vocational counseling for these amputees.

Counseling filled an immediate need on the part of the patients. The majority of them were young (under 23),

A patient at Mare Island Naval Hospital is visited first by a yeoman from the educational services office, who starts off the rehabilitation program with a discussion of his background and interests. A follow-up visit by a Wave educational services officer encourages constructive thinking about vocations

Occupational therapy plays a large part in the rehabilitation program. Working in the leather shop is only one of the many opportunities offered amputees at Mare Island Naval Hospital

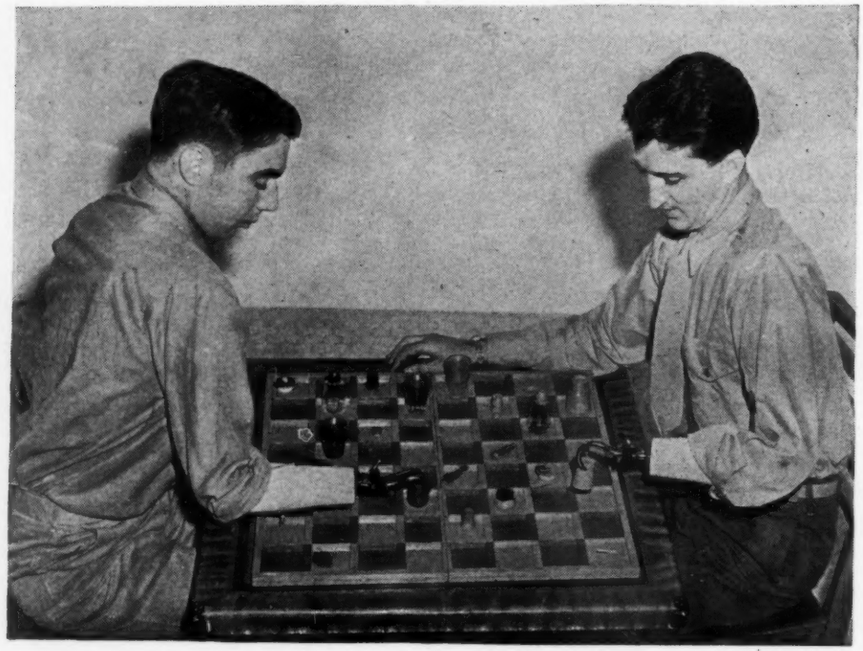
relatively uneducated (11th grade or less), and had little work experience of a skilled or even a semi-skilled nature. Those who had chosen an occupation were woefully uninformed as to the amount and character of the education and experience they would need.

However, after the patient's interest had been aroused as a result of counseling, and he started thinking about himself in relation to his immediate vocational future, the educational services office found itself with a new responsibility—that of finding an outlet for the man's ambition. Suppose the patient wanted to try his hand at automobile mechanics, where could he get his training and experience? He ordinarily would have to wait for his discharge from the hospital and the naval service before he would have the opportunity either for trade school training or a trainee job in a garage. Should a man let his talents lie fallow for the months that would comprise his convalescence?

To eliminate this problem, the educational services office extended its operations beyond the mere counseling interview into the world outside the hospital. The man who needed more schooling was sent to school (this was found to be a more satisfactory solution than signing him up for a correspondence course). The man who wanted to learn a trade, or relearn a skill he used in civil life, or try his hand at one or more types of employment, was given the opportunity to engage in a "work-training" program.

Under the work-training arrangement, a patient was permitted to go to work for an approved employer—for pay. At first patients were permitted to work only for employers who were within commuting distance from the hospital. Later this arrangement was extended to permit patients who needed no further surgery to sleep "ashore" and check in at the hospital one day a week. This change made a much wider choice of jobs available, since it extended the area of operations. Incidentally, because of various legal and practical difficulties, particularly the "dual compensation" law, it was not feasible to develop work-training programs within the Navy Yard at Mare Island.

An example of the arrangements made between the hospital and employers has been the one worked out with the Tide-



gested that he might be interested in reading a popular U. S. Armed Forces Institute textbook entitled *The Small Business*, and that he might be interested in taking a battery of psychological tests which would give him valuable information regarding his abilities.

When the Wave officer visited Johnny a couple of weeks later, she found that he had been taking penmanship and fly-tying from the occupational therapy department, that he had finished his psychological tests, and had read the book on the small business from cover to cover.

There's more than one way of learning to use an artificial hand. Left, two amputees practice by playing checkers with odd-sized objects; below, patient gains dexterity—he has to pass a test before he can return to civilian life

water Associated Oil Company, whereby the hospital has been able to supply the refinery with a small number of reliable and intelligent employees, who made up for lack of skill by enthusiasm.

Let us follow the progress of a former Mare Island patient, now a Tidewater Associated employee, whom we shall call Johnny Meyer, ex-private first class, U. S. Marine Corps Reserve.

Johnny lost his right arm below the elbow in action on Okinawa. He was admitted to the U. S. Naval Hospital at Mare Island in March, 1945, after being flown in from the Western Pacific. On his third day at Mare Island, he was visited by a yeoman from the educational services office. In response to the yeoman's casual questions, Johnny said that he was a high school graduate and that college was not for him, but that he would like to get into some kind of work that would give him a chance to cut a hunk of future for himself and the girl back home in Kentucky. He thought that he might like to go into business for himself—maybe a grocery store—but was not sure exactly what he would like.

A week later Johnny was visited by a Wave educational services officer. She found him in a conversational mood, so they talked for upward of an hour of the various kinds of business he could start. The educational services officer found that Johnny had very little idea of what "going into business for himself" involved in the way of experience and capital outlay. She did find that he wanted a job that would keep him outdoors much of the time, that he preferred to work with "things" instead of with ideas and abstractions. She sug-

He had discovered through his work with occupational therapy that he had a fair amount of skill with his left hand, and he was still making progress. However, he was discouraged by what he had learned in the textbook.

"It looks as though a fellow had to go through a peck of trouble to go into business for himself," he stated. "I don't think I'd like to mess with so much paperwork and red tape."

Johnny and the Wave officer next turned their attention to the tests he had taken. These tests indicated that his interests and abilities were strongest in the mechanical and manipulative fields, and weakest in the clerical and language fields.

Getting a Real Job

It was at this point that the educational services officer began discussing the various jobs in the local area, at which Johnny could try his hand. She recommended, in view of his interests and aptitudes, that he look over the opportunities available at the Tidewater Associated refinery, 20 miles away, where there were several different kinds of jobs available, both indoors and out. Johnny said that he would have to put off any decision till he had gone home on leave.

The educational services officer assured Johnny that he would have no difficulty in finding work at Tidewater, and he promised to see her on his return from leave.

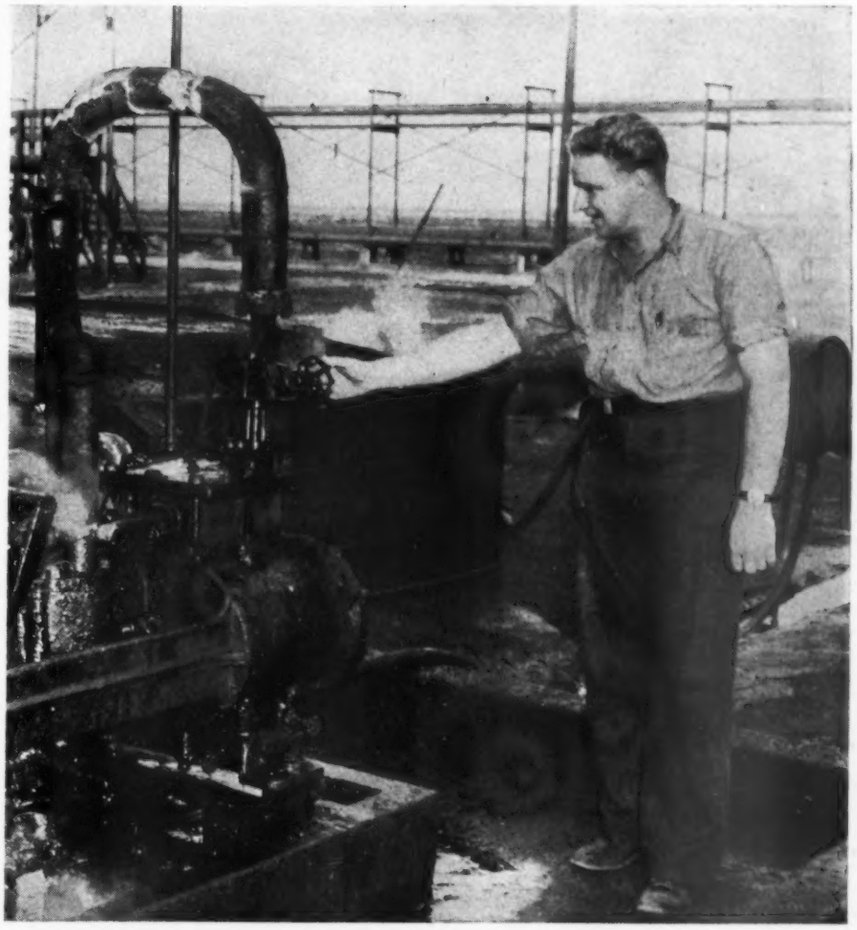
A few weeks later Johnny came back from leave and dropped in to see the educational services officer. The information that he had gathered in his home town, and his conversations with business men there, had verified what he had read in the book on the small business—it was not for him.

"I could have had a dozen jobs back there," he said. "The station agent at the railroad offered me a job as a clerk for $7 a day, even without an artificial hand. Said I would be better than the last three guys he had on the job put together. But who'd want to spend the rest of his life pushing a pen in a railroad office?"

Johnny also could have had several $30-a-week jobs with various local firms, with opportunities to learn the business from the ground up, and there were a couple of war plants in his area where he could have had a $10-a-day job as an inspector or a plant guard.

"Not for me," he told the educational services officer. "I don't want to work for $30 a week, unless I absolutely have to, but I do want something permanent. How about this work at the refinery?"

The Wave officer suggested that he go out to Tidewater Associated and see for himself, issued him a one-day pass for that purpose, and gave him the necessary directions to get to Avon, where the refinery is located.



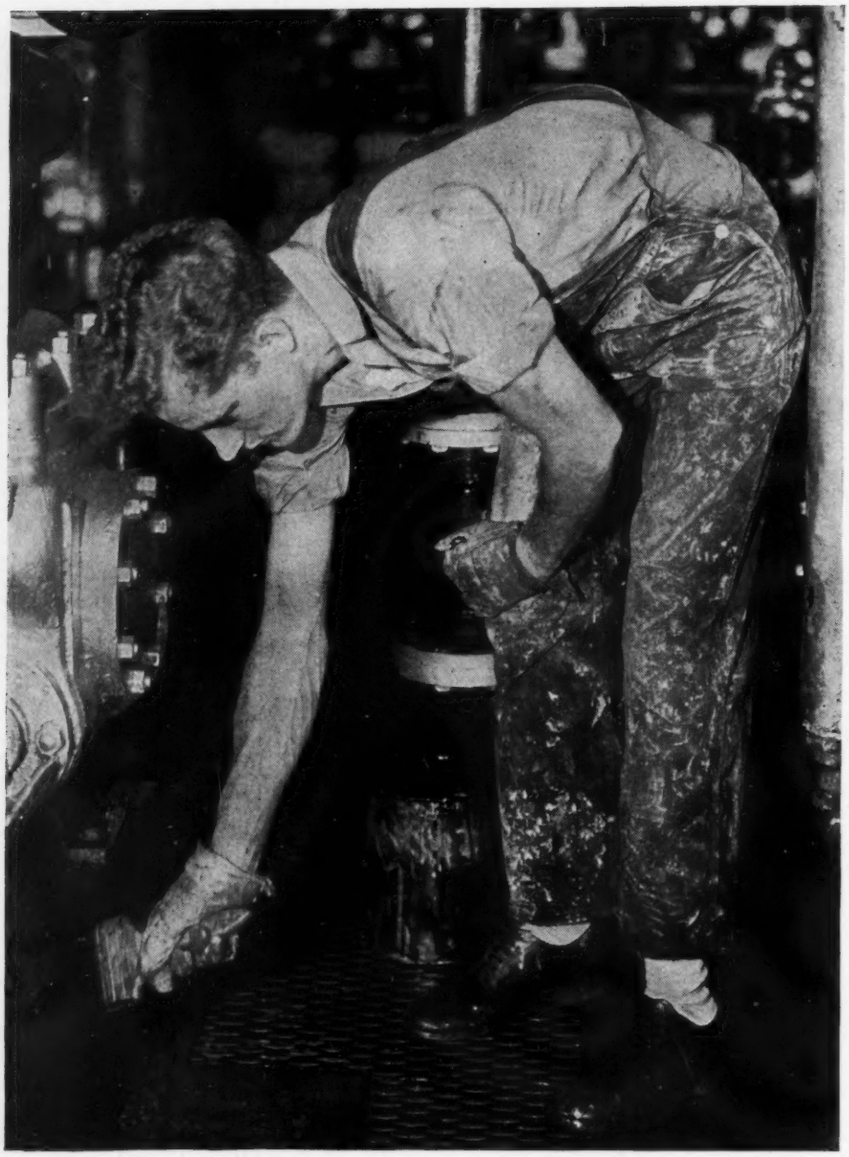
At work, with regular pay, patient now operates a crude lube distillation unit at Tidewater Associated Oil Company. He is really "on his own," because he lives away from the hospital, has only to report once a week

At Avon Johnny was met by the personnel manager, himself an ex-Marine, World War I. He showed Johnny around the refinery, giving him detailed explanations of those jobs in which Johnny expressed an interest. He introduced Johnny to foremen and supervisors. They watched other amputees at work, and discussed the problems of adjusting to the job and adapting the job to the disability.

At the end of the tour of the plant, the personnel manager and Johnny sat down to a frank discussion of the jobs he could fill successfully. The manager explained that he would have to start at the bottom, but that the job was permanent and the pay good—$50 to $60 per week to start. Johnny decided that he would like to start as a still operator helper, an outdoor job.

On returning to the hospital, Johnny checked in again at the educational services office where a work-training permit was filled out for him. This permit, signed by his medical officer and the executive officer of the hospital, enabled him to work at Tidewater Associated as long as his work was satisfactory and he reported in at the hospital once a week.

During the remaining three months of his convalescence, Johnny lost time from work only once—when he was fitted with his artificial arm. When he returned to the refinery with his new arm, the personnel manager encouraged him to wear it on the job, and other refinery workers with arm amputations showed him various tricks and angles they had worked out to aid them in their work. Johnny found out, for instance, that he was better at opening and closing valves than a man with two normal hands, because his steel hook gave him added leverage, and he was soon climbing up and down ladders and performing the many duties of his job as well as or better than any other man. As a direct result of this practice he was able to pass the artificial arm perform-



Rehabilitation is considered complete when the former patient feels that he is holding down a job on his own merit, and he takes pride in his ability to do as good a job as the man next to him. This ex-Marine works in the compound department of Tidewater Associated Oil Company, operating pumps, obtaining samples, and doing general work

ance test at the hospital's occupational therapy department with little difficulty.

While working at the refinery, Johnny slept and ate with his buddies in special facilities provided by the Tidewater Associated Oil Company at a nominal fee. This obviated the necessity for traveling to and from the hospital each day, and spending his earnings for high-priced food at restaurants and quick lunch counters.

The rehabilitation office of the hospital was kept informed of Johnny's progress by weekly reports. An unsatisfactory report would have resulted in a conference between Johnny and the educational services officer to ascertain the cause of the maladjustment and to find some other activity.

Nor did the interest of the personnel office of Tidewater Associated end with placing Johnny on the job of his choice. The personnel manager or his assistant dropped in frequently to see how Johnny was getting along, and when, after five weeks of employment, Johnny decided that he was making enough to send for the girl back home and marry her, they helped locate a comfortable house in nearby Concord. Today, several months after discharge, Johnny is still working at Tidewater Associated and, while he occasionally gets an urge to go back to Kentucky and take a flier in the grocery business, he has little difficulty in suppressing the desire, because he knows he has what every man wants—the kind of work he likes, security, a wife, and a home.

The story of Johnny Meyer's rehabilitation is perhaps undramatic, but it presents the result of a planned program of rehabilitation. The educational services office did its part by giving Johnny as accurate a picture as possible of his own potentialities. While it punctured his dream world of a post-war grocery store, it presented him with something concrete. It taught him to think of himself in terms of abilities, not disabilities. It then gave him an opportunity, with the cooperation of Tidewater Associated Oil Company, to try his hand in the world of work, to unwind and readjust away from the unnatural world of military life.

If Johnny had failed on his first job at the refinery, the personnel office would have tried him out on others. If the oil industry had not been to his liking, the educational services officer would have made other arrangements for a tryout with other companies, equally cooperative, but Johnny was lucky, in that he hit the jackpot on the first try.

Combating "Hospitalitis"

The Mare Island rehabilitation program is one which emphasizes action as the antidote to "hospitalitis"—inertia, lethargy, and pointless day-dreaming. Hospitalitis is the dry rot which threatens a man who is hospitalized over a long period of time. With no constructive means with which to make a bid for the success of his future, his plans and hopes wear away or become fantastic dreams, and his ambition leaves him. If left untreated, hospitalitis may become a permanent disability.

Rehabilitation at Mare Island proposes to prevent hospitalitis or eliminate it in its initial stages by a planned program of counseling which orients the patient toward a tangible occupational goal. There are no strings tied to the work he undertakes in any of the work-training jobs. The patient keeps the money he makes and receives no special privileges, other than that of permitting him to report to the hospital once a week, at his own expense. He is made to feel that he is holding down a job in the world of work solely by his own merit, and he takes pride in his ability to do every bit as good a job as the man next to him, amputation or no amputation.

When he has achieved that feeling, the period of rehabilitation is over.

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

Test chamber sunk into floor for safety uses centrifugal force to find flaws

Subterranean Pit Insures Safe Testing

A safe method of using centrifugal force to test aluminum castings and forgings has been developed by Aluminum Company of America, Cleveland. Sunk into the floor, in a 4-ft. wall of reinforced concrete, is a "Whirl Pit" which absorbs shock and retains parts "exploded" under the stress of the testing, so that danger to operating personnel is eliminated.

In this subterranean chamber, rotating engine parts are whirled at speeds far in excess of actual performance requirements. The natural action of the centrifugal force, generated by this "over-stressing" technic, distorts, or stretches, the part tested. A study of this distortion, revealed by coating the part with a brittle lacquer which cracks at known amounts of strain, indicates the distribution and level of stress caused by the whirling action. Engineers can then use these data in redesigning to eliminate hidden weaknesses.

In one recent test, a 13¾-in. diameter impeller was whirled at a speed of 25,500 r.p.m., or 1475 feet per second. When it burst, after having been run to destruction, the flying particles were hurled at a speed faster than a 0.45 caliber pistol bullet traveling at peak velocity.

To absorb such a shock, and to retain the exploded parts for study, the pit is lined with 25,000 pounds of laminated steel and wood absorption rings, backed up by a 1¾-in. steel tank, and a 4-ft. wall of reinforced concrete. It can accommodate parts up to 5 feet in diameter. When in operation, a vacuum is created within the pit, which sharply reduces the power required to rotate test parts.

•

For the "Party-a-Month" program at National Cash Register, Dayton, workers may purchase season tickets at a slightly reduced price. Individual tickets also can be bought. Selling season tickets makes it easier for the committee to estimate attendance.

•

Color on Doors Reduces Accidents

R. HEDBERG, Plant Engineer, HPL Manufacturing Company, Cleveland

Bands of bright orange, 6 to 8 inches wide, painted on the bottom edges of overhead doors, have saved maintenance and reduced accidents in our plant. These bands help to make it obvious if the door has not been raised enough to clear high loads coming in or going out on trucks. They are especially helpful on outside doors that trucks have to back under. Bands of the same color are used also on low balconies or any other overhead obstruction.

We use the orange color in our plant because it is also used for traffic lanes, and our employees are familiar with it.

Before this color marking, overhead doors were considerably battered, and frequently needed repairing so that they would close properly. And accidents caused by people banging their heads on the overhead doors have been greatly reduced.

•

Informative Booklet Welcomes Visitors

Through the use of an informal 8-page booklet, a visitor to the General Luminescent Corporation, Chicago, is immediately made aware of the company's cordial, friendly atmosphere.

When he calls at the receptionist's desk, he hands in his card and mentions the person to whom he would like to speak. A moment later, he is handed a small booklet,

WELCOME
to
GENERAL
LUMINESCENT
CORPORATION
Mr. Carl G. Ryder
Whether this is your first visit or fiftieth, we want you to know we are glad to see you.
for your CONVENIENCE
Our telephones are for your convenience too – use them freely – our operators will get you your number.
Any G.L.C. employee will show you the shortest Quickest route to the nearest washroom.
also
Up to date time-tables
your reference may be
tained from our switch-
rd operator.
atch pads and pencils
vailable to you–Just
y stenographer.

Visitors at Chicago plant are greeted with informative booklet listing products and services

titled "Welcome. . .," with his name inscribed on its cover. The suggestion is made that it may be necessary to wait a few minutes before he can speak with the person he has come to see, and that he may find the little pamphlet of interest while waiting.

Within its pages are listed the company's products, the names and positions of "Persons you may wish to see," and services available, such as telephones, time-tables, etc. These are illustrated by informal black-and-white sketches. A letter from the company's president welcomes the visitor, and sets forth the company's friendly policy toward those who call upon it, either as prospective customers or as salesmen from other companies. Of particular interest and help to out-of-town visitors is a small map of the Chicago Loop, which points out various places of interest, as well as the location of the General Luminescent Corporation's offices.

•

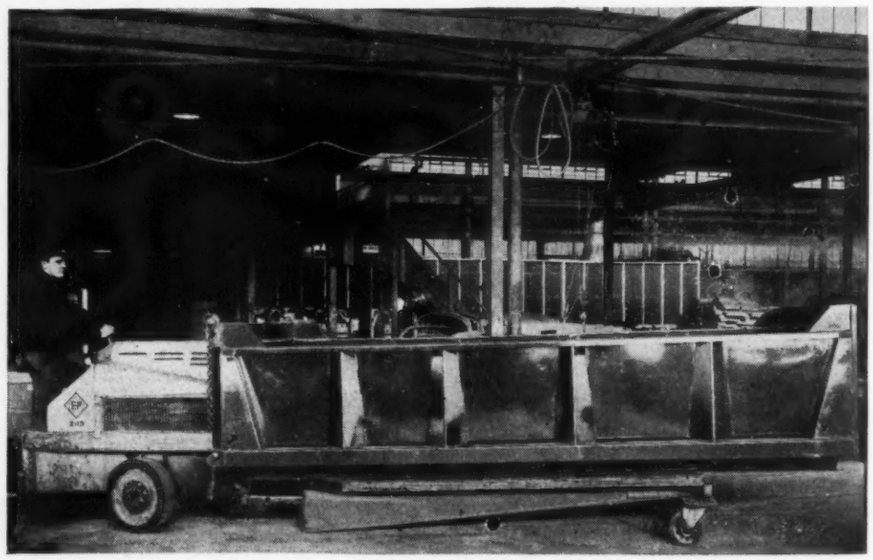
Dolly and Truck Move Long, Heavy Loads

SOURCE: The Elwell-Parker Electric Company, Cleveland

Long and heavy objects, such as the dump-truck body shown in the photograph, may be transported readily by means of a two-wheeled dolly and a low-lift platform truck. This body, approximately 15 feet long, 3 feet high, and 6 feet wide, was fabricated by welding heavy steel plates together. It was lifted onto the dolly by overhead crane.

The dolly itself was made from steel plate, with the sides shaped and turned down, as illustrated. The forward end was mounted on wheels, and the rear end rested on the floor when not in use. The upper surface of the dolly was practically level, and high enough for the truck's platform to be pushed underneath it.

By lifting the rear end of the dolly off the floor, the entire load is supported on wheels, four on the industrial truck and two on the dolly, and in this way it may be moved easily anywhere in the plant.



Two-wheeled dolly and low-lift truck transport dump-truck body

MAINTENANCE SERVICES

The well-maintained plant is the high-production plant

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

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New Title or Position .....

FACTORY MANAGEMENT AND MAINTENANCE
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42nd STREET, NEW YORK 18, N. Y.

VOLUME 104, NUMBER 2 · FEBRUARY, 1946

MAINTENANCE as the Editors See It

Power Cables Need Protection From Fire

FAILURE TO PROTECT cables properly in junction boxes and manholes has cost many a plant serious losses through fire and service interruptions. On the other hand, there are plenty of instances where suitable protection at such places has kept delays and damage down to the minimum.

It will pay to keep these facts in mind when new power lines are being installed, or existing lines revamped. In fact, some time can be spent very profitably in making a careful inspection of all places where cables are bunched together, and seeing to it that potential trouble spots are effectively cleared up.

When a fault develops in a cable, the heavy arc that results is likely to set fire to any combustible material nearby, including the insulation on other cables. Hence a relatively minor trouble may develop into one of major proportions.

Preventive measures are simple and inexpensive. They involve merely wrapping combustible cables with, say, a couple of layers of asbestos tape, which is then coated with sodium silicate or a suitable fire-resisting paint. Such protection is needed also by lead-sheathed cables. A heavy arc will melt the sheath in a very short time, thus exposing the insulation.

When an important cable goes out, a lot of equipment goes with it. Anything that can be done to localize or minimize troubles of this kind almost certainly will pay off in a big way.

Make Only What Cannot Be Bought

DETERMINING SOUND POLICY in the matter of making certain kinds of equipment, and spare parts for other kinds, is something that ought to be given early attention. During the past three or four years a good case could often be made out for such practices. Intolerable delays frequently were experienced in getting parts. At the same time production had to be kept going, no matter how. Or some kind of equipment was badly needed. Deliveries were weeks or months ahead. A reasonably satisfactory item could be made up in the shop, so why not make it?

Measures that are necessary in emergencies may not be justifiable under normal conditions. Certainly many conditions affecting plant operation have changed considerably during the past few months. Emergencies are not quite so pressing, and whatever is needed to meet them usually can be obtained with less delay than was previously experienced.

Every maintenance department worthy of the name has men and equipment that are capable of turning out various kinds of wood and metal parts, possibly complete machines. Hence the temptation to make at least some kinds of spare parts and other items frequently is strong.

Any advantages of that practice must be viewed from the standpoint of the quality and cost of the work. There is always a serious likelihood that home-made parts are inferior to the genuine article in some important respect—choice or quality of material, heat-treatment, accuracy of dimensions, or whatever.

Granted that the parts or items are physically the equal of the purchased variety, there is another strong likelihood that accurate cost records would show that it costs more to make parts than to buy them. The difference in cost may be hidden, or disregarded, but it is nevertheless there.

It is not the function or purpose of the maintenance organization to serve as a production department.

Be Sure Safety Devices Will Operate When Needed

ANY KIND OF SAFETY DEVICE that cannot be depended upon to function properly when needed is likely to be worse than none at all, because it creates a false sense of security. Such is the philosophy of one maintenance chief. As the direct result of that philosophy none of the numerous safety devices of all kinds in one large plant has failed over a long period to operate properly in an emergency.

There is oftentimes, unfortunately, a tendency to assume that most safety devices need little attention. Usually they operate only infrequently, hence it is taken for granted, perhaps almost unconsciously, that there is no chance of anything wearing or getting out of order. There is enough truth in that assumption to make it dangerous.

In the plant referred to, no chances are taken as to the condition of any device whose failure to function may endanger personnel or property. Flame controls on ovens and boilers, thermostats on electrically heated equipment, circuit breakers, elevator safeties, the fire alarm system, machine guards and safety devices, relief valves—all are carefully inspected and operated frequently enough to make it as certain as anything can be that they, and other devices of like nature, will not fail at a crucial moment.

Whether these inspections are too frequent, too thorough, too costly, is a matter of opinion. The fact that cannot be brushed aside is that no safety or control device in this plant has been found inoperative when needed.

Area Foremen Simplify Maintenance Control

H. E. HARDENBROOK, Works Engineer, Buick Motor Division, General Motors Corporation, Flint, Mich.

PROPER AND ADEQUATE MAINTENANCE at Buick is based first upon correct philosophy, second, upon technical performance. As to the first, it may be said that the closer it is possible to pin down responsibility for a routine job, the greater the likelihood of getting the job done promptly and properly.

To carry out this general theory, the 6,500,000 square feet of plant area at Buick is divided into six areas with six area foremen. The area foreman is considered a junior works engineer for his area, and is responsible for keeping everything running smoothly and constantly in that area. This applies to everything except productive machine tools. The central maintenance division sets up a new installation and stays with it until the spindle is turning, or the furnace is operating properly, or whatever the facility may be; but from that moment on it is the area foreman's job to keep it running.

The composition of these area groups varies with the kind of equipment. An assembly area has more millwrights, because of the necessity for conveyor maintenance; an area in which fabrication predominates has more electricians, because of the large number of motors involved. Productive workers are served by maintenance craftsmen—pipefitters, millwrights, carpenters, and electricians—depending on requirements.

Central maintenance, aside from new installations and rearrangements, functions on jobs that cannot be done in the areas. A floor repair or a motor overhaul, for example, is done centrally on a work order initiated by the area foreman. But in the area jobs are done without paperwork. Work done outside the area maintenance group does require an expense or work order, or an

Maintenance men get around the plant more than other workers, therefore the life-saving corps at Buick is made up predominantly of maintenance workers. Here they are practicing artificial respiration

"Buried and forgotten" cannot be applied to water mains. This one developed a leak, and the maintenance man is recalking it

order to serve as a record for the location of equipment. If a machine is to be moved out of an area, a move order on the central department is written by the area foreman, which serves as a basis for a notation on the equipment record as to the exact location of that machine or piece of equipment. The area groups, in summary, do spot preventive maintenance.

The relation between the area maintenance foreman and productive supervision is a further exemplification of the philosophy of individual responsibility. The area maintenance foreman is responsible to the production superintendent in the area, but reports back to the superintendent of maintenance functionally. Control of area maintenance expense is obtained by established ratios to dollars of productive labor, which vary with conditions in the areas. No red tape is involved. Written reports from the areas to the central maintenance office are non-existent; and detailed memoranda to the area foreman from the central maintenance office are considered poor practice. The idea is to have area foremen get into the habit of thinking for themselves; if detailed instructions are issued they may forestall a better method which the foreman has thought up, but would hesitate to use in face of the instructions. All maintenance foremen meet weekly in the superintendent's office for professional discussions, for consideration of safety and manpower requirements, and for consideration of special conditions which are causing or are likely to cause difficulties.

Special Crews

Certain functions, although strictly maintenance, are not handled by area foremen. Transformers and high tension cables are maintained by a special crew under its own foreman. This crew looks after transmission of power from the utility and the power house up to the point where it is stepped down to 440 volts for use in the areas. This arrangement is primarily for reasons of safety. Maintenance of cranes and elevators is taken care of by a plant crew, apart from area activities. Here uniformity in practice and adherence to insurance regulations are the important considerations which set this function apart. There are 13½ miles of steam lines from the power house to the buildings, and a special maintenance crew patrols the tunnels constantly—two men per shift. Their responsibility stops at the shutoff valve in each building—there the area maintenance crew takes over.

Certain items of equipment such as building heaters, which need to be checked only at relatively long intervals, are entered on cards in a tickler file by equipment name and location. The times of inspection are determined by the maintenance foreman in the weekly meeting with the maintenance superintendent. Cards are filed in the central office. At the date specified, the card is sent to the proper area foreman who makes the examination, notes the condition and the date inspected, and returns the card. Frequently, however, the cards are not sent out, but are talked over in the weekly meeting. Experience indicates that area foremen do not depend upon these cards—a desirable condition—but they serve as double check on the part of the superintendent of maintenance

An exhaust stack subject to vibration needs regular attention, and maintenance men have to climb high to tighten the joints and prepare the stack for repainting

It is evident from the foregoing that preventive maintenance is the keynote of the entire maintenance organization. With this philosophy and with the organization set up to establish individual responsibility, the technical side of maintenance is next.

Cables used on elevators, cranes, and hoists call for special care. Hoist cables used in operating departments are inspected daily, at noon when production is stopped. The safety cable thrown over the hanger for the hoist is checked at the same time.

On air hoists an additional item to check is air leakage. If a chain is used on a hoist, broken links are not welded —a new chain is installed. Nor is any cable used for load service spliced, for safety reasons. Crane and elevator cables are inspected weekly. Each cable is run through the inspector's bare hands, and the broken strands are counted. The allowance, before the cable is replaced, is in accordance with the ASME Code. In addition, the insurance company inspects four times a year.

Cranes and elevators are oiled monthly, bearings are checked, crane tracks are checked for alignment, and controls are checked for arcing. Notations of these inspections are entered in the crane and elevator book by the special crew which does nothing but look after this class of equipment.

Electric trucks are checked daily at the charging panel in each maintenance area. As the trucks come in each night the driver reports minor troubles. The maintenance man in the area greases the truck, goes over switches, controls, and brake mechanism each night. Batteries are charged. A board is kept in this area, where the number of each truck is noted and the date greased marked opposite the truck number. If the area foreman of maintenance finds that a lot of time is being spent on maintaining a certain truck he gets the approval of the production superintendent for a general overhaul by the central maintenance department.

Conveyor Upkeep

Conveyors are always checked by maintenance area men before they are used. On chain conveyors, a daily inspection is made to see that hooks are not out of kilter, that the drive mechanism is in order, and that there is not too much slack.

Steam lines are checked both by area men and by a special crew operating from the central department. The latter crew looks after steam lines between buildings. They check steam traps for proper operation, and expansion valves. The rollers on expansion valves are checked daily as the tunnel men make their rounds. If the steam line is cold, the trap must be opened and inspected. Each day the area foreman inspects the panel board for steam lines entering his building.

Maintenance tools are checked periodically. Tradesmen's personal tools are called in each month, as well as all company tools checked out of the maintenance toolcribs. This is a safety precaution to keep all tools in safe working condition; and, too, it prevents special tools remaining out on the job indefinitely.

Pressure vessels, such as steam and air piping, enamel and gasoline installations, are checked for design and installation with the insurance companies to make certain that all safety regulations are followed.

Plating, degreasing tanks, and heat-treat ovens are the area foremen's responsibility. Temperatures of the various solutions used in plating must be checked constantly, and temperatures in drying ovens must be maintained. Area men check them at the start of each shift. If steam is used for drying, a temperature drop is likely to be caused by a plug in the steam trap; if electricity is used, sticky relays may be the cause. Temperatures of plating and degreasing tanks are checked frequently during each shift.

High voltage lines and transformers are the responsibility of a central maintenance department crew. For transmission lines, the condition of the insulation is of prime importance—this is determined by an insulation resistance test. If a cable splice is not properly done, and moisture gets into the insulation, the cable will gradually fail. An insulation resistance test is run on all high voltage underground cable twice each year.

Oil in transformers is tested each year for its insulation value and moisture content. Then, too, the oil from one-half the plant transformers is filtered and dried every other year by concern specializing in this business.

Motors are a large item in Buick maintenance, because there are some 20,000 of them. Motor voltage is on a 440-volt, three-phase, 60-cycle line, stepped down from the utility 4800-volt line. The light line is 120-volt, single-phase, 60-cycle. To prevent getting 110-volt motors, the master me-

Portable workbenches save time and travel. At Buick one bench is assigned to every electrical journeyman. It is stocked with all the miscellaneous small parts necessary in electrical wiring

Ⓐ

MOVE ORDER
ELECTRIC MOTORS ONLY

No. M-10921

Date 8/23/45

Motor No. 33438

Serial No. M-L-1170	Make General Electric Mtr.
H.P. 3	Speed 1730
Volts 440	Frame 225
Phase	Model No.
	Work Order No.

Works Engineer
Gen. Accounting
Mach. Tool Div.
File

Ⓑ

MOVE ORDER
MACHINERY AND EQUIPMENT

No. M-10921

To FACT. #25 Dept. #66-69-74 Date AUGUST 23, 1945

Move equipment described below- NOTE: If space below is inadequate, attach separate sheets. Description must be complete

DESCRIPTION: (Show equipment no. when possible)

MOVE: GENERAL ELECTRIC MOTOR, BUICK #33438, SERIAL #M-L-1170, 3 HP, 1730 RPM, 440 VOLT, 60 CY., FRAME #225.

NOTE: VIA. 25-70 REPAIR.

From PRESENT LOCATION			To NEW LOCATION		
Plant 11	Bldg. 11	Dept. 01	Plant 11	Bldg. 11	Dept. 01

Ⓒ

MOTOR AND EQUIPMENT RECORD

Serial No. M-L-1170

Ⓓ Date	Factory	Dept.	Floor	Bay	Section	Move Order No.	Machine Name & No.
						13202 WE	
5-8-34	11	09		14	J	39198 "	KRUEGER DRILL 48898
9-6-40	11	17				9959 "	
8-5-41	25	70		4	C	10453 "	GREENLEE #39753
12-5-41	11	01	1			40634 MM	" "
1-27-42	26	SURP.	Bldg. 94			1786 MM	GREENLEE #37083
12-31-42	26	"	" "			10921 WE	MACHINE #39753
8-23-45	11	01	" 11				

When equipment or a motor is moved for any reason, three "paper" steps are taken. First a move request (A) is made out in pencil by the area foreman; second, a move order (B) is typed in central maintenance; third, the new location is marked on the equipment record (C and D). On the face of the record card a full description of the equipment or motor appears; on the back is a complete record of its previous locations. Here a motor is to be taken from a machine, sent to repair, and then returned to the same machine

REPORT ON PERIODICAL INSPECTION OF WORKS ENGINEERING EQUIPMENT

Mr. Prahl-Knutson — Card No. 102

Description Instructions: Inspect all outdoor lights (includes bracket lights, pulley operated fixtures, etc.). See that brackets are properly secured. Note particularly condition of chains and hangers. Area men to observe all in their areas, and electrical department to inspect all pole lights and others not within any maintenance area.

Frequency of Inspection: 3 Months

REMARKS (NOTE—If remarks & report require more than one line, make same in note form and attach)	Insp. Date	Signed
Surveyed O.K.	8/17/42	cbp
Checked and repaired	5/19/43	cbp
" "	10/15	cbp
" " "Hellcat" track changed to 300	12/2/43	cbp
Surveyed O.K.	12/6/44	cbp
	8/28/44	cbp
Working on #19 lights	1/10/45	cbp
O.K.	5/22/45	cbp
Surveyed O.K.	9/15/45	cbp

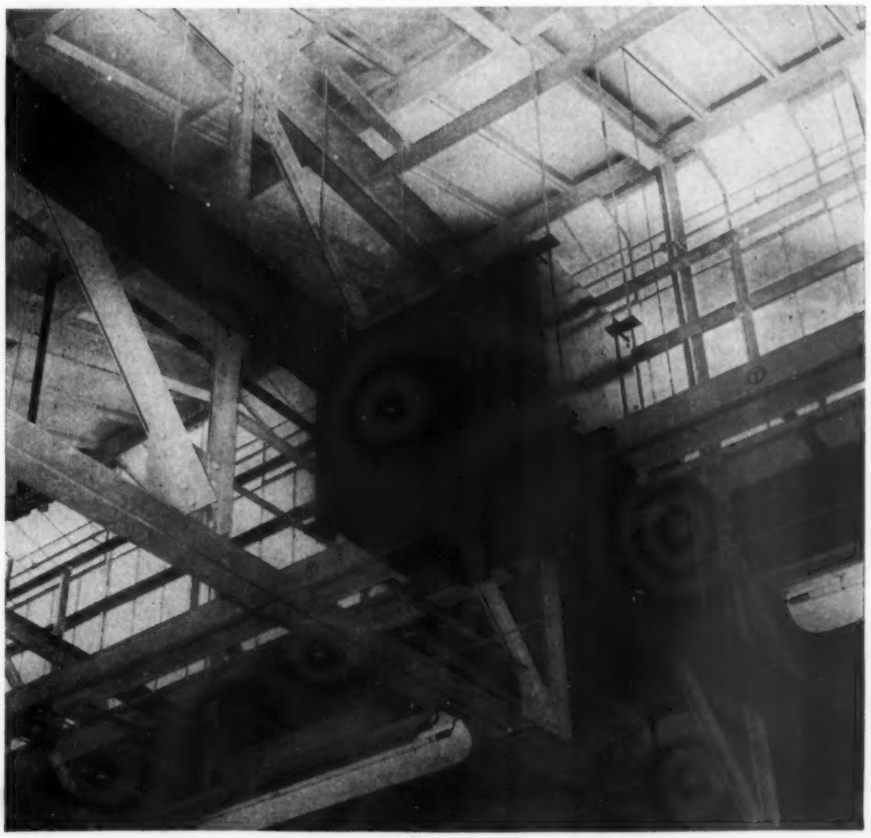
chanic will not order a machine with motor attached without the okay of the works engineer. This is to avoid plugging motors in on the light circuit.

Power factor is, of course, a most important consideration. This is checked every 15 minutes in the power house and correction is made; also, static condensers are installed in the areas to improve power factor. All air compressors, and motors over 75 horsepower generally, are installed with synchronous motors for the same purpose. Motor loading, too, is important. A lightly loaded squirrel cage induction motor lowers power factor—it is best, therefore, to let it run at overload. If a machine maker uses a 5-hp. motor when a 3-hp. would do, power costs increase. The extent and duration of the overload are, of course, checked with a graphic meter.

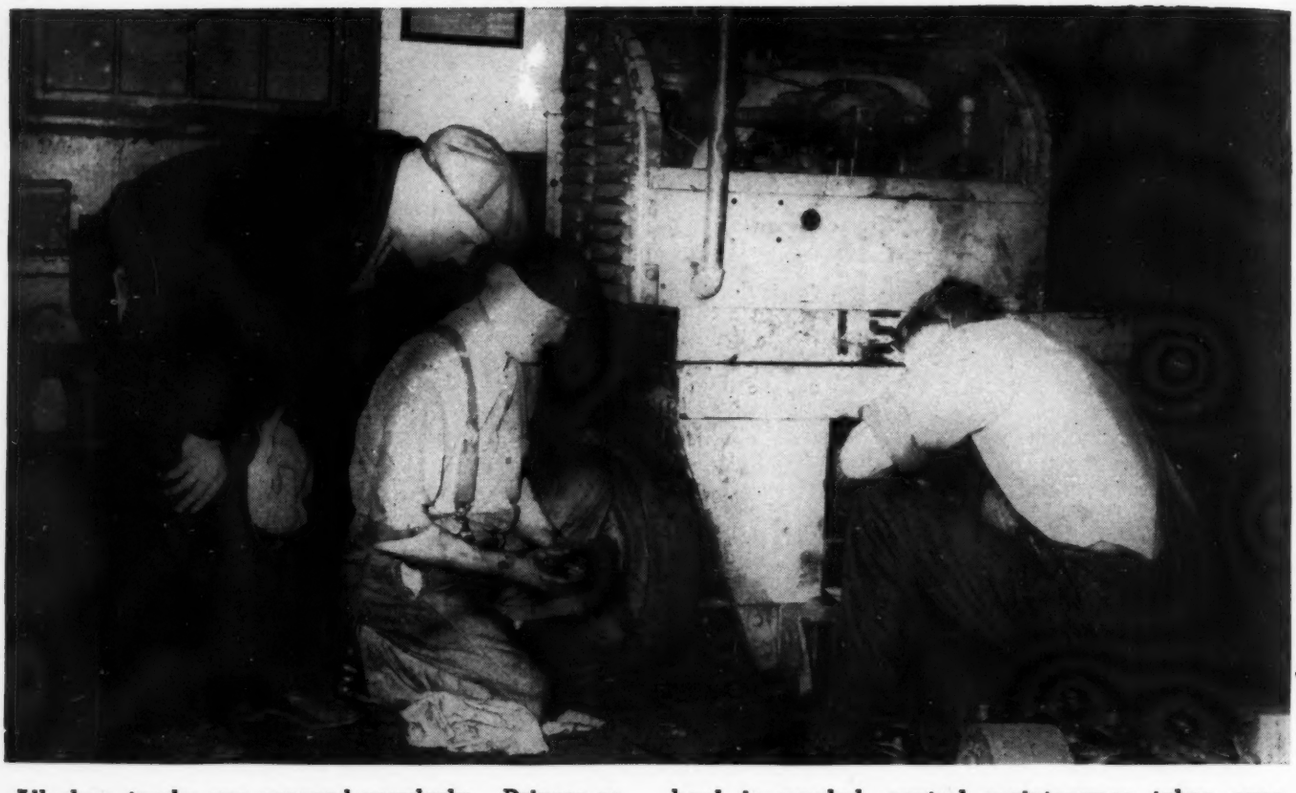
Motors in each area are the responsibility of the electricians in the area groups. Each electrician has only the number that he can take care of properly. Indications of trouble show up as motors are oiled—that is, if special trouble is not brought to the attention of the area maintenance man by the production operator. Ball-bearing motors are greased every three months, and sleeve-bearing motors continuously. At these oilings, the motor is examined; if it is running hot, the relay may be too big, or the airgap—tested by a feeler gage—may be too small. Again the motor may not be electrically balanced; this is checked by a voltage test to see that all three phases consume the same amount of current.

The first indication of motor trouble

For maintenance work that is done on a regular schedule, at more or less lengthy intervals, cards are kept in the works manager's office. As the appointed time approaches, duplicate cards are sent to the area foreman concerned, who sees that the check is made, reports findings or results on the card, and returns it to the central office



Although an overhead power distribution installation itself may be trouble free for years, it feeds a system of power-consuming motors—and somewhere down the line trouble is likely to develop. Continuous checking and regular inspections keep such troubles at a minimum



All shop trucks are greased regularly. Drivers report minor troubles daily, but when a major overhaul is needed, central maintenance takes over, on the request of the area foreman

is the motor kicking out under load. It may not be overloaded, but the thermal relay may be too small. If the relay is too big, it will not kick out, but it will heat. When the electrician is called to a productive operation by a motor kick-out, relays may be at fault, all contacts in the disconnected switch may not be working. If overload seems to be the trouble, a chart is made from a graphic meter. If spot checking cannot correct the difficulty at once, the motor is replaced and the checking done in the central maintenance department. This test will tell if the motor is overloaded, the V-belt is too tight, bearings are out of line, or the spindle is starting to freeze.

Annual Testing

The insulation resistance test is used periodically to test the resistance of the motor winding. On large motors this is done every year.

A recording meter is frequently used to track down unusual conditions or freak situations. For instance, in one part of the plant there is a large door operated by electronic control, which opened mysteriously at 9 p.m., remained open for a few minutes, and then closed. The recording meter indicated a voltage jump at 9 p.m., caused by changing circuits in the power house. The jump made the electronic controls function improperly. This condition was corrected by putting a constant voltage transformer ahead of the controls.

An electronic control is placed as a shutoff device on furnaces using gas and oil. Fuel source may fail momentarily; if the fuel should come back suddenly an explosion might result. The electronic control prevents fuel return until the area maintenance man has corrected the faulty condition.

The area electricians may find that a relay in the distributing switch serving a part of the shop kicks out. This difficulty starts a search for grounds.

Preventive maintenance practiced by area men is further exemplified by heat-treat and welding operations. In one area using both gas and electricity for heat-treat, three area men are assigned to furnace maintenance for each shift—one pipefitter and two electricians. They see that the gas flow is properly regulated, maintain the electric controls and the pyrometer controls, and check water flow to quench tanks. In the case of electric welding units using transformers, all contacts and regulators are checked each week; welding heads are checked daily to see that water is flowing through properly.

Building maintenance is the responsibility of the area maintenance groups. Some of the buildings are mill type construction; and, in moving material about, a production foreman may load beyond bearing capacity. The maintenance area foremen, therefore, are asked to check floor loads monthly. General building repairs are watched also, and roofs are checked every two months. The heater units used in heating the buildings are taken down each year and the cores are boiled to remove accumulated dirt.

Individual Responsibility

Detailed practices have been mentioned to indicate that satisfactory maintenance depends upon correct organization theory—that individual responsibility for specific jobs must be assigned and recognized. If this is done, and area people are expected to think for themselves, a minimum of checking centrally by reports is the result. Area groups are organized by trades in accordance with the jobs to be done in the respective areas. The over-all control and the development of techniques are furthered by the weekly meetings of the area maintenance foremen with the superintendents of maintenance. Liaison of area foremen with line supervision is provided by the maintenance foreman sitting in with production supervision in meetings called by the production superintendents.

Clean Air Reduces Product Rejects

C. D. GOODSELL, Plant Engineer, Weston Electrical Instrument Corporation, Newark, N. J.

BY APPLYING CLEAN AIR to a hermetically sealed room where white instrument dials are spray painted, the Weston Electrical Instrument Corporation, Newark, N. J., has reduced spoilage of finished instrument dials to less than one-third the number originally rejected for dirt-spotted appearance.

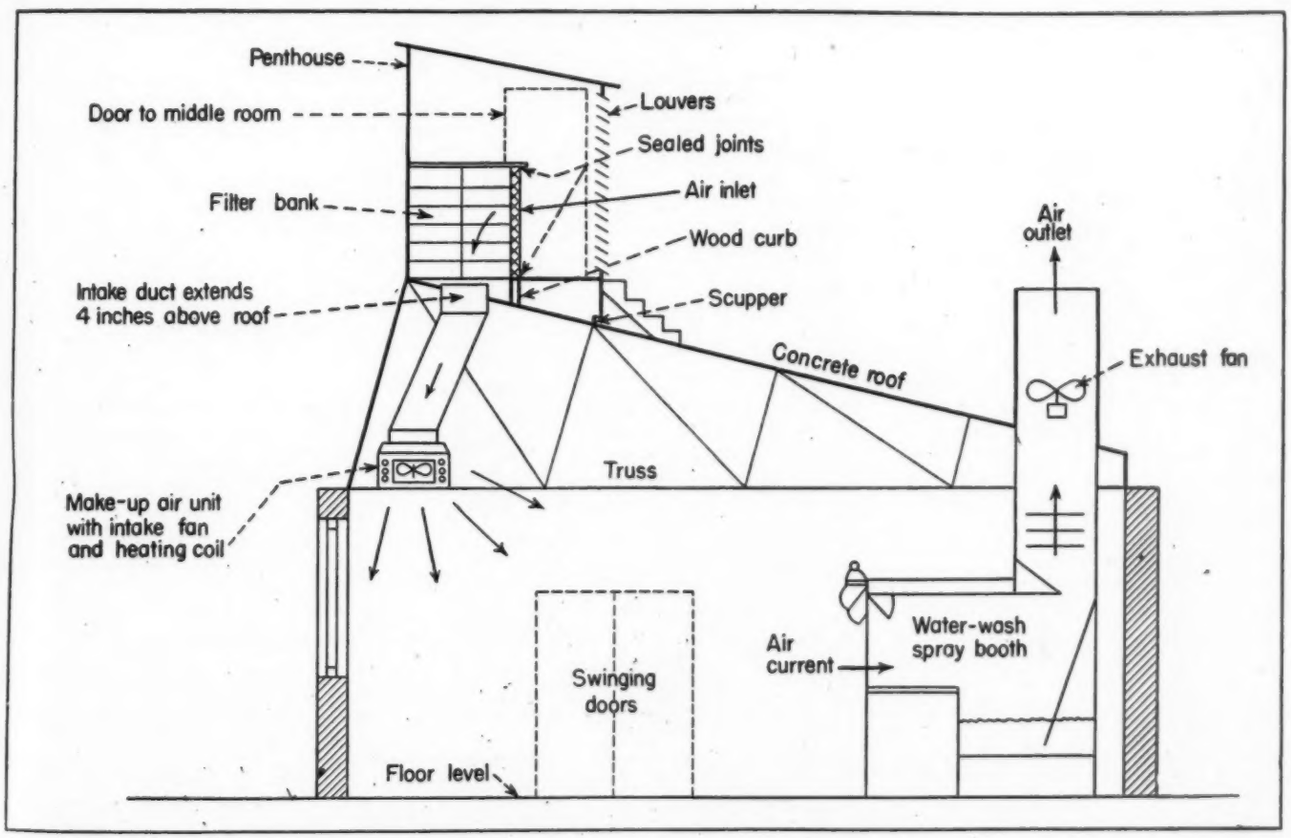
In addition to insuring clean air for the dial painting room by first passing all incoming air through a filter installation, the company keeps this air clean by preventing infiltration of foreign dusty air currents into the room. This is accomplished by maintaining the room under a slight positive pressure which more than counteracts the vacuum caused by the mechanical exhaustion necessary to remove the fumes from the painting process carried on within. It is now possible for employees to enter or leave the white dial room through swinging doors without danger of creating dusty drafts.

Easy to Maintain

Ease of maintenance of the air-filter system has also been considered in its design. It was this factor that led principally to the final improvement in the development of the air-filter system, involving construction of a penthouse, for location of the filters, above the dial painting room. The air filters are easily accessible in this location, and can be quickly and conveniently serviced by special equipment also kept there, without the necessity for entering the dial painting room.

Before the war, instrument dials were processed in the same room as now, but in much smaller quantities, by applying the enamel finish in two individually exhausted spray booths. Because of the multiplied demand for dials under war contracts, these booths were replaced by a six-compartment booth employing the water-wash system for paint reclamation.

One of the well-known features of such a booth is its exhaust system, which draws the air directly away from the operator, past the spraying operation, into a curtain of down-flowing water,



Elevation diagram of room where white instrument dials are spray painted shows how incoming air is cleaned by filter installation in penthouse and is fed into hermetically sealed room. Rate of intake maintains room under slight positive pressure to keep exhaust system from sucking in dusty air

and finally out through an overhead exhaust duct that contains the motor-driven exhaust fan. If the air in the room is dusty, this flow of air inevitably causes dirt specks to be deposited on the enameled dials. Such specks, according to governmental specifications, were cause for product rejection.

In order to keep rejections from this cause to a minimum, it was realized that all air drawn into the white dial room would have to be filtered. Other physical conditions also pointed to the wisdom of this plan. Immediately outside and across the yard about 50 feet away was located the company's soft-coal pile. Whenever the jib crane got busy on the coal pile, black dust naturally began to fly. In addition to this periodic disturbance, new building construction work and other plant changes that created offensive dust were continually taking place in the near vicinity of the dial painting room. The situation was so sensitive that whenever a pipefitter working outside the room jarred the pipes, injurious dust would be created. No wonder that the dial rejections for dirt spots often ran as high as 30 percent!

The white dial room is 24 feet long and 26 feet wide, with a saw-tooth roof extending over its full length in one span for the entire room width. The lower level of the saw-tooth begins 9 feet above the floor, and rises to a peak about 6 feet higher. The near-vertical section of the saw-tooth roof consists of a continuous run of solid non-ventilating glass sash.

Facing the Coal Pile

In the original filter installation, the duct openings for bringing the outside air to the two sets of air filters were located at two points in the solid glass run of the saw-tooth roof, one at each end. Although these openings faced the coal pile, no alternative location seemed possible. Air was drawn through each duct opening and was pulled through a system of filters which was located immediately inside the grille close under the roof. From there the air flowed through a short neck down to the motor-driven fan unit, containing heating coils, which dispersed the air from overhead into the white-dial painting room. The heating coils were designed to heat the incoming air automatically to a well-regulated room temperature during cold weather, and were inoperative during the summer.

Positive pressure was obtained for the air in this room by blowing a larger quantity of filtered "make-up" air into the room than was being exhausted by the water-wash ventilating system. For instance, the ventilating system had two vertical exhaust ducts, each containing a 34-in., 6600 c.f.m. fan, driven by a 3-hp. motor. The make-up air was furnished by two filtering system with fans each of 7800 c.f.m. capacity.

An identical air-filter installation was placed in operation for another room, just behind the white dial room and accessible to it by an open doorway, which was used for painting black dials. Since the rejection problem was greater on the white dials, however, all efforts were focused particularly on the white dial room in an effort to eliminate the dust which was causing the high rejection rate.

The filtered-air make-up system as thus first designed, however, did not function very well. The capacity of the air filters was limited by their design and location, so that they needed frequent cleaning. Clogging of the filters gradually reduced their capacity to a point where the scheme of positive pressure failed, and product rejections again mounted because of dust sucked into the room by the spray exhaust system. Cleaning of the filters, too, was not convenient, and required about 3 hours' labor each time.

There being no fault to find with the basic principle of maintaining positive room pressure by supplying clean make-up air in excess of the amount exhausted, the plan of overcoming the difficulties just described by provision of the present penthouse facilities was conceived and put into effect. This improved installation has been in operation more than six months, during which time white dial rejections have dropped from a high of 30 percent to a low figure of 8 percent, with prospects for further improvement when the abnormal outside dusty conditions are eliminated.

The schematic elevation diagram on page 143 shows how the filtered air is drawn into the room from the penthouse and exhausted through the ventilating stacks.

The penthouse, which is 6 feet wide and 7 feet high above the roof peak, extends almost the full width of the white dial room below it. It is partitioned inside into three sections. At each end of the penthouse is a room about 7 feet long containing a filter unit. This unit is of the removable frame type, using metallic screens impregnated with viscous oil as the filtering medium. Outside air enters into each of the filter rooms through wood louvered openings, about 6 feet square, which have been purposely located on the side opposite the coal pile. This louvered design has proved effective against entry of driving rain and snow into the filter rooms. What little water does get in drains itself out on the sloping roof through small scuppers provided for that purpose.

Spare Parts Storage

The middle room of the penthouse contains spare filter frames, also the equipment needed to service the used filter screens. This equipment consists of galvanized sheet steel sinks for washing, steaming, and rinsing the screens, and a sink for soaking the screens to impregnate them with clean oil. Need for this servicing, which requires less than an hour each time, is shown by a differential pressure gage on each filter unit. It appears that servicing now seems necessary only about every 2 months instead of every 2 weeks as formerly with the first arrangement.

Access to the penthouse is by a ship ladd outside the building, extending from the ground to the roof, without need for disturbing the manufacturing operations. The interior of the penthouse is reached from the roof by a short stairway leading through a door to the middle room, and the air-filter rooms are reached by interior doors from the middle room. Two windows over the sink equipment in the middle room provide ample illumination.

EVERY MONTH, AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to WHAT'S NEW in EQUIPMENT (page 168) . . . a summary of LABOR DEVELOPMENTS (page 236) . . . things YOU WANT TO KNOW more about (page 228)

Inventory Charts Visualize Condition of Equipment

THOMAS R. CRELLIN, Head of Maintenance Department, Leeds & Northrup Company
Philadelphia

BY QUICKLY GLANCING over a series of wall charts in the maintenance office of Leeds & Northrup Company, Philadelphia, anyone can easily tell the physical condition of all motors, machine tools, and auxiliary machines in that plant.

In effect, these charts are a visual perpetual "conditions inventory" of all important equipment in the plant. Such information, of course, is of special value to the head of the maintenance department and his assistants.

These charts list separately, in two main divisions, every motor and machine, and show by any one of several differently colored markers set opposite each item whether that item as last reported is in good, fair, or poor condition. They show, too, if an emergency repair is under way. They also show when the item is not in use and being held in stock, and when a piece of equipment has been sold or discarded.

The use of these charts developed from a need for easier and quicker follow-up of the results of periodic maintenance inspections that were being made on all motors and machine equipment. For several years before an organized preventive maintenance program, of which the inspections were an essential part, had been effectively disclosing conditions that needed to be remedied to avoid high maintenance costs or interrupted production. It was noticed, however, that even after routine work orders were issued to correct these improper conditions the needed repairs were not being made as quickly as they should.

Orders Accumulated

Rush repair orders often did not get the required attention. Other repair orders accumulated to the point where they constituted an unhealthy backlog of preventive maintenance work.

In fact, it was not until the injection of a visible inventory of the current condition of all important equipment, by the use of wall charts, that these drawbacks to an otherwise effective preventive maintenance program were eliminated, and the benefits fully realized.

It is now possible to spot immediately any dangerous accumulation of repair orders, and to stimulate prompt action for their completion. It is likewise possible to concentrate on emergency repairs, because of the constantly visual warning given of their existence until completed. Both these functions depend on the proper maintenance of a color-coded marker for each item on these charts.

There are eight separate wall charts, each 20 inches wide by 30 inches long, comprising the complete plant inventory of motors and machines. Of these, three are used exclusively for machine equipment, and five for motors, and all are captioned at the top accordingly. Each chart is made of ½-in. plywood, covered with a layer of brown battleship linoleum.

As shown in Figure 1, each chart is divided into four identical groups of columns, with 50 items in each group. Each group has headings to show the motor or machine number, and to describe the condition of this equipment. Horizontally, the headings read "No.," "Stock," "Good," "Fair," "Poor," and "Emer.," the latter an abbreviation for emergency.

The first vertical "number" column runs from 1 to 50, the second from 51 to 100, and so on, totaling 200 numbers on each chart. Successive charts are likewise consecutive in numbering. Numbers and headings were made on aluminum strips by means of a lettering machine, and the strips nailed to the chart with round-head brads. The horizontal and columnar rulings on each chart were drawn with black draftsman's ink. This inexpensive construction has proved durable and workable.

To indicate on the chart the status or physical condition of any piece of equipment as reported by an inspector, thumbtacks of various colors are placed in the vertical columns. If the equipment is reported in "good" condition, a white thumbtack is placed in the "good" column opposite the number representing that equipment. Similarly, blue is used for "fair," yellow for "poor," and red when an "emergency" or rush repair is needed. When the equipment is in stock, a green thumbtack is used. For equipment that has been sold or discarded, a black thumbtack is inserted to the left of the equipment number. Black items are listed indefinitely, and the numbers are never used again. Obviously, the maintenance department strives to keep all active numbers white.

Effective plant maintenance lowers unit product cost

A Planned System

Behind the functioning of the motor and machine charts lies a carefully planned system of preventive maintenance that needs brief description in order to understand how the wall charts are made to give an up-to-the-minute inventory of the conditions of all equipment. This equipment, incidentally, is spread over 7 acres of floor space in 15 multi-storied buildings, and requires a maintenance personnel of about 90 employees to keep it running for 24 hours each day over a normal 6-day week.

To begin, a record of every motor and every machine in the plant is kept on a separate white card, entitled "Equipment Inspection and Repair Records" (see Figure 2), which is filed in one of two file drawers identified as "Electrical Equipment Record" and "Machine Equipment Record" respectively. In the electrical equipment record are included cards for all motors and generators (ranging from 1/10 up, a.c., d.c., or synchronous) which drive machine tools, elevators, air compressors, air conditioning equipment, and similar apparatus. Motors of portable fans and portable hand tools are not included. In the machine equipment record are included cards for all machine tools and auxiliary plant equipment.

Each piece of equipment shown by these cards has been given a "maintenance-file" number, which is placed on

EQUIPMENT INSPECTION AND REPAIR RECORD

EQUIP. No. MG-6 NAME 1/4-hp. motor

CLASS Annually LOCATION Inspection test room

Date	INSPECTED BY	CONDITION	REPAIRED BY	TIME	COST
5/1/43	E. Ross	Cleaned, overhauled, and painted	Miner and Heinemann	6.0	4 80
5/1/44	E. Ross	Cleaned, replaced bearings	M. Gallen	2.0	1 60
5/1/45	E. Wohlers	Cleaned, checked, oiled, etc.	De Mers	3.0	2 55

EQUIPMENT INSPECTION AND REPAIR RECORD

EQUIP. No. 59 NAME 18-in. Henry & Wright drill press

CLASS July - Oct. - Jan. - Apr. LOCATION Shop "S"

1945 Date	INSPECTED BY	CONDITION	REPAIRED BY	COST
6/19	O. Sande Req. No. 4863	Quill key worn	Smith and Kirschner	
9/5	O. Sande	Fair		
10/5	O. Sande	Good		

MECHANICAL INSPECTION REPORT

Mach. No. 59 Date Insp. 10-5-45

Location Shop "S" Next Insp. Date 1-5-46

Drill Press

Part	Good	Fair	Poor
Spindle or bearings	X		
Carriage			
Tail stock			
Shears (bed) cross slide			
Head			
Lead screw or nut			
Gear change			
Clutch			
Countershaft		X	
Table	X		
Saddle			
Feed screws or nut			
Feed box and mechanism			
Oil feed			
Pump			
Turret and slide			
Driving pulleys ~~and gears~~	X		
Elevating screws or nut	X		
Belt ~~and chain mechanism~~	X		
Collets			
Centers			
Chucks			

General remarks:

Inspector O Sande

Date 10/5/45 Final Insp. by W. Finlay

ELECTRICAL INSPECTION REPORT

Equip. No. MG-6 Inspector De Mers

Location Inspection Test Date Insp. 5/1/45

Drives Generator Next Insp. 5/1/46

Part	Good	Fair	Poor
Bearings	X		
Shaft	X		
Winding	X		
Collector rings			
Brushes			
Commutator			
Coil		X	
Rheostat	X		
Oil			
Ground			
Wiring			
Switch		X	
Fuse			
Insulation resistance			

General remarks

Details of repair Cleaned, checked, oiled, and painted. Motor O.K.

Electrician De Mers

Date 5/1/45

Final Insp. by E. C. Wohlers

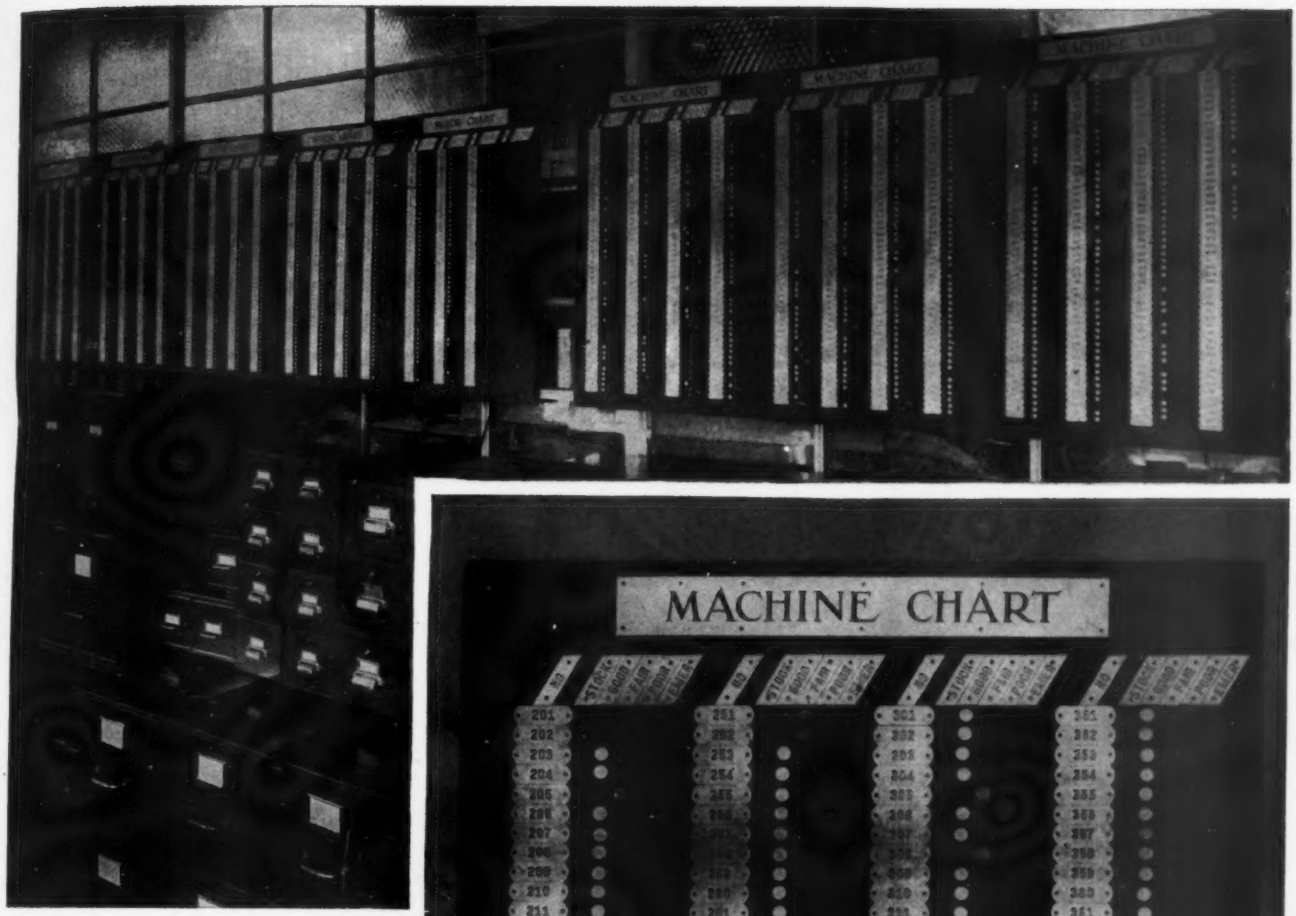


Figure 1 (above). Eight wall charts list by assigned numbers every motor and machine in the plant, and show by white, blue, or yellow markers in specified columns whether equipment as last reported is in good, fair, or poor condition. Other columns (see close-up view) show when emergency repair is under way (red marker), or when item is in storage (green marker). Equipment sold or discarded is shown by black marker

←

Figure 2 (left). Routine of preventive maintenance inspections relies upon individual equipment cards (two upper forms), which describe equipment and show frequency. These cards are kept chronologically in separate files for motors and machines. When an inspection has been completed by use of an electrical or mechanical check chart (two lower forms), the results are posted on wall chart, details are entered on equipment card, and card is moved forward to date of next inspection

CONTINUED ON NEXT PAGE

the motor or machine, and also is shown in upper left corner of the card. Numbers for each of the motor and machine groups both begin at No. 1, and are assigned consecutively as additions to either group are made.

The plan for numbering each item of motors and machine equipment in these equipment records is of significance. There is no physical tie-up between the motor and machine of the same maintenance-file number. Neither is there any tie-in between the maintenance-file numbers and the capitalization numbers applied and used by the accounting department for inventory and cost purposes. Both relationships were attempted at one time or another before the development of the system to its present phase, but found impracticable.

An Impractical Procedure

If, for example, it was attempted to use the same number for a motor as that of a machine it powered, difficulties arose when motors were changed, or a group drive was involved. Likewise, any effort to follow capitalization numbers in maintenance records ran into trouble on large equipment, such as an air conditioning installation, which might have several motors, yet be assigned only one capitalization number by the accounting department.

The plan of applying "maintenance-file" numbers consecutively from No. 1 for both motor and machine groups has proved practicable because the maintenance of motors and machine equipment is handled by separate divisions of the maintenance department. From that viewpoint, too, correlation of motor and machine numbers is unnecessary. Moreover, segregation of these numbers permits the acquisition of separate costs for electrical and mechanical maintenance of any machine, which is frequently of value in determining its performance.

Now to show how the electrical and machine equipment records are used as a basis for scheduling and ordering preventive maintenance inspections. Each file drawer is subdivided into calendar months, and into these subdivisions the equipment cards are placed according to the desired frequency of their inspection. As the inspections are made, the cards are moved forward to the due date of the next inspection. Upon completion of a scheduled monthly inspection, for example, the card is moved the next month ahead, and for a quarterly inspection 3 months ahead, and so on.

Inspections on motors are usually scheduled for 3-, 6-, or 12-month intervals. In the 3-month group are found motors used in severe and around-the-clock service, such as on air conditioning equipment, vacuum pumps, and water coolers. Motors in less severe but important service are inspected semiannually, such as for machine tools, cranes, elevators, and stokers. Motors on equipment that runs intermittently, such as exhaust blowers and conveyors, are inspected annually.

On machine tools, the inspection schedules vary from weekly, monthly, bimonthly, and quarterly up to semiannually and annually. Punch presses get a weekly inspection, and most drill presses, lathes, and screw machines a monthly inspection. Small drill presses and milling machines are inspected bimonthly or quarterly, heavy grinders semiannually, while slow-moving machinery like large shaper-planers are inspected annually.

The method of assigning preventive maintenance inspections is as follows. Using the equipment record as a guide, a blanket work order is issued at the beginning of each month to the supervisors of electrical and mechanical maintenance, accompanied by a list of all equipment to be inspected in that month. This list shows the maintenance-file number of each piece, its location, and, for the electrical list, also the number of the machine on which the motor may be found. Each list is issued in triplicate for distribution to the inspector, supervisor, and office foreman, so that as the work is being completed, the items can be checked off by the men.

Separate Forms

Progress of work is followed in the office by receipt of a written report for each item from the inspector, who uses blank check charts previously provided with work order on which to record the results of his inspection. Separate forms (see Figure 2) have been designed to take care of electrical and mechanical equipment. These reports show by check marks in one of three columns whether the itemized parts of any equipment are "good," "fair," or "poor." The reports are turned in daily to the office foreman, who scrutinizes each report to determine if any remedial action is necessary. He also decides, from his familiarity with all equipment, whether the motor or machine deserves an overall good, fair, or poor rating. This decision dictates what color thumbtack he must place on the visual wall chart against the item inspected.

This procedure takes only about 15 minutes every day. Following this, for all "fair" or "poor" reports a requisition for a work order is issued, and the originally completed inspection report is returned with the work order to the repair supervisor, who holds the report until the repair is completed. After that, the report is referred by the supervisor a second time to the inspector, who makes a final inspection, and indicates his approval by signature and date at the bottom of the report card.

When the "good" report card comes back to the office, the colored thumbtack representing the defective item is replaced by a white tack in the "good" column. Concurrently, the details of the results of the inspection as to date, inspector's name, condition of equipment, and nature and cost of repairs, if any, are entered on the card in the equipment file, and the card is advanced to the next inspection period.

Red Signals for Emergencies

Incidentally, this same card is used to record similar details of all other intermediate repairs made on this equipment, thereby affording a complete and valuable maintenance history. Cards for equipment held in stock are kept in a separate file, and therefore do not come up for attention.

Red signals may appear on the wall chart from either of two causes. When an inspector discovers a defective condition that is serious enough to warrant shutdown of a unit for immediate repair, he reports it at once to the maintenance office. A rush order is issued, and a red signal set up on the chart. Or if a breakdown should occur, a red signal is immediately placed on the chart for that unit as soon as the requisition for repair is received in the maintenance office. In the last two years, however, since the inception of this system, not one single breakdown has occurred. This, it is felt, is conclusive evidence of the success of the visual method of follow-up, and has led to plans for seven additional boards for plant equipment not previously numbered, such as chain hoists, cranes, and unit heaters.

The routine of making preventive maintenance inspections requires the service of a full-time mechanical inspector on one shift per day, and 3 hours' time from each of 2 electrical inspectors for all three shifts each day. The mechanical inspector also makes whatever minor adjustments are necessary while he inspects each machine. In addition, the clerical work involved requires one-half of one office worker's time every day. There is every evidence that this expense is far more than compensated for by the savings in direct and indirect maintenance and production costs.

As for the visual approach in the use of wall charts to reveal unsatisfactory plant conditions, this method has led to maximum effectiveness of the program at negligible extra cost.

Series Capacitors Raise P.F. of Resistance Welders

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THE RESISTANCE WELDER, like other inductive devices has poor power factor, which means it draws a large reactive component from the line. It differs, however, from other low power factor loads in that the load is intermittent, and usually single phase. These low power factor loads occur for periods from a few cycles to a few seconds on a repetitive basis.

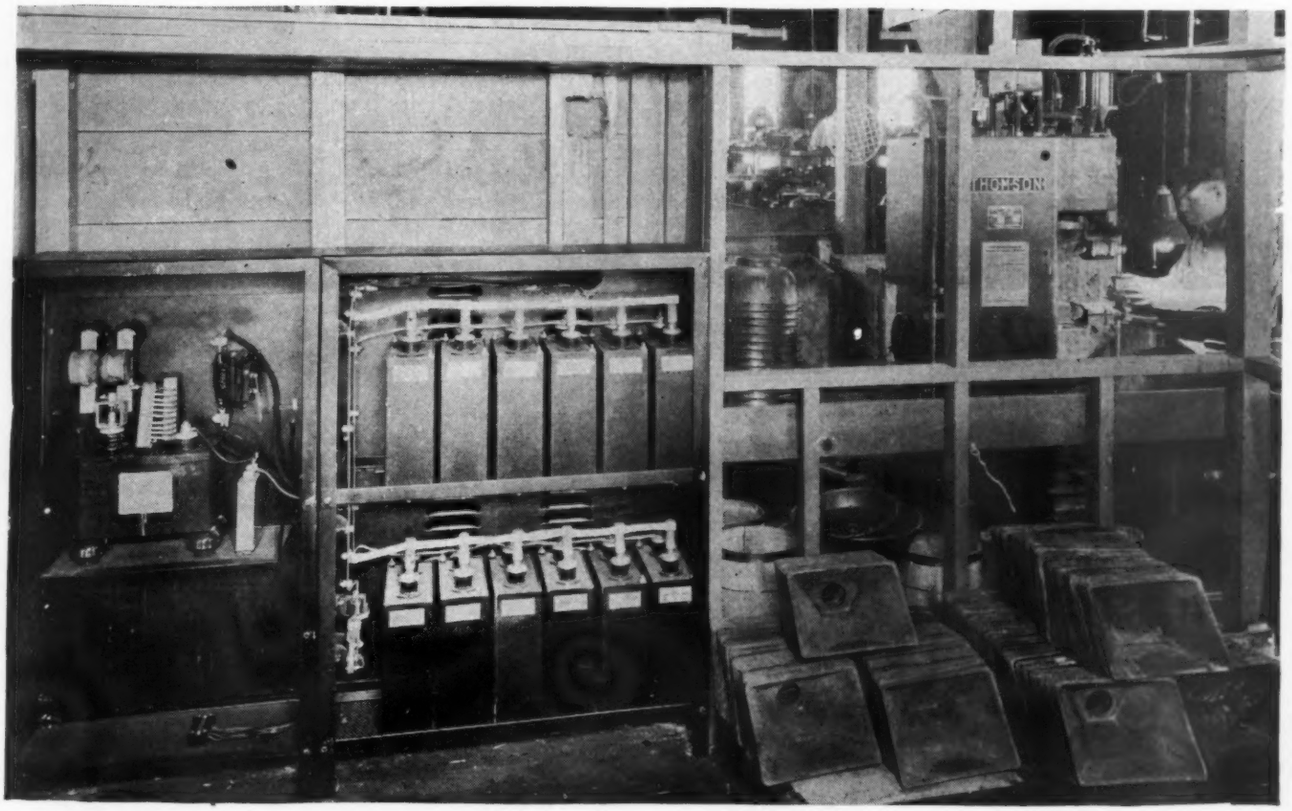
Since these demand peaks occur repetitively the associated voltage dips often cause annoying flicker of lights. Even when the dips occur only within the plant, those caused by one welder may affect the quality of welds produced by other welders.

The utility can install lines and transformer equipment sufficiently large to supply these momentary peaks and maintain adequate voltage regulation, but the investment usually is uneconomical, because of the relatively small revenue derived from the power consumed by the welders. Welder loads may therefore present a problem both to the utility and to the user.

A resistance welder is nothing more than a transformer with a predominantly resistance load on its secondary. The power factor is low because the secondary must be wound for very low voltage and very high current. With this high current in the secondary a very small inductance, such as represented by only a few feet of wire, results in a large magnetic field. This secondary circuit is kept as short as possible, but the loop formed by the electrode leads introduces enough inductance to make it difficult to keep the power factor above 50 percent in most instances. The presence of magnetic material in this field, or throat as it is usually termed, aggravates the condition noticeably but cannot be avoided.

Even if the power factor were not low, a resistance welder load would consist of a succession of large repetitive peaks, but by eliminating the reactive portion the peaks usually can be cut to about half and this improvement is well worth while.

Use of a capacitor to supply kilovars



In this installation gap protection is provided to limit the voltage of the series capacitor when the welder electrodes are brought into contact. Such protection for the capacitor usually is not required

required by inductive loads, and thus reduce the total kva. demand from the line, is well known. Since most loads are relatively constant the capacitor usually is connected in parallel. Such capacitors are termed shunt type. For example, the full-load current of a 100-hp., 1200-r.p.m. motor may be reduced 8 percent by a 25-kva. shunt capacitor.

The motor usually runs for considerable periods and even though a shunt capacitor may increase the starting inrush current this is commonly of no importance. If, however, the motor is subject to repetitive starts, or a varying load causes objectionable dips in line voltage, a shunt capacitor would not improve conditions, except for reducing the effective heating current in the line. A shunt capacitor draws a high inrush of current each time it is energized, and therefore cannot be made to offset a momentary current inrush, such as caused by motor starting.

It is usually not practicable, therefore, to install shunt capacitors on resistance welders, especially if one is primarily interested in eliminating voltage dips such as cause lamp flicker or poor performance of other welders on the same circuit. A shunt capacitor is more likely to aggravate the condition by subjecting the welder control to large current transients that exceed the limits of these devices, or create difficult problems in the control of the welding cycle or welding current.

It is possible to overcome this objection by pre-charging a shunt capacitor and synchronously connecting it to the welder, but considerable additional equipment is involved, and due to the presence of harmonics it is not a satisfactory solution, even if cost is ignored.

A series capacitor creates an out-of-phase voltage component that offsets the reactive voltage component in the welder; therefore the line peaks can be held at or near values that would be obtained if the inductance could be removed from the welder transformer and its throat. Many series capacitors have been used for this purpose and satisfactory results are obtained, especially in applications where the reactance of the welder does not vary widely, as is usually the case.

There are two essential differences in shunt and series capacitors. Shunt capacitor units are designed with internal discharge resistors to discharge them automatically after a time, when they are disconnected. Series capacitors, however, must hold their charge to avoid the recharging transient that would otherwise occur at the beginning of each weld. Hence, they are made without internal discharge resistors, and a separate means is used to discharge them only when the welding machine is to be shut down.

Shunt capacitors usually are rated to match up with standard line voltages. Series capacitor voltage ratings are governed by the welder machine design and characteristics, as well as by the line voltage, which necessitates a wide range of capacitor voltage ratings.

Also, shunt capacitors are rated on a continuous-voltage basis, usually operate continuously, and cannot be subjected to voltages much in excess of rating. They are applicable on circuits whose average voltage over a 24-hour period does not exceed the rated voltage by more than 5 percent, or where the short-time operating voltage is not more than 110 percent of the nameplate rating.

Series capacitors operate at a voltage that varies from zero to the voltage existing during weld, which period usually is small compared to the total time. The effective or equivalent con-

Using Series Capacitors With Resistance Welders

1. **Simplifies supply problem**
2. **Improves voltage regulation**
3. **Reduces voltage dips**
4. **Permits operation of welder on circuits otherwise inadequate**
5. **Permits operation of welders during previously restricted periods**
6. **Minimizes interference between welders operated on the same circuit or in the same plant**
7. **Improves quality of welds**
8. **Cuts power bills, particularly where instantaneous kva. demand is used in billing**

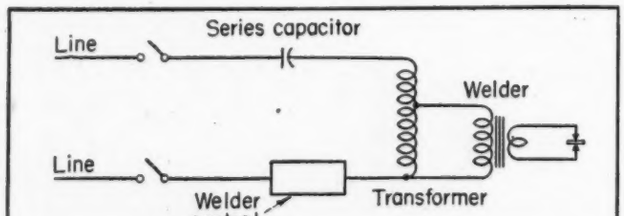


Figure 1. An autotransformer used to permit operation of a welder with a series capacitor and avoid uneconomical capacitor ratings

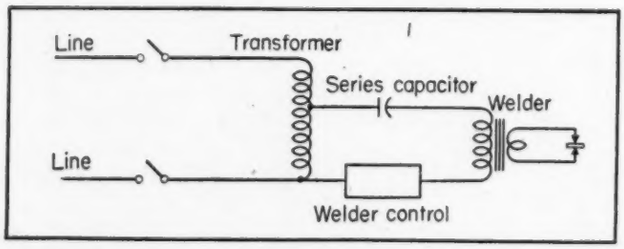


Figure 2. Placing transformer ahead of welder and capacitor avoids high voltage on tube control, but is not satisfactory on voltages less than 230 volts

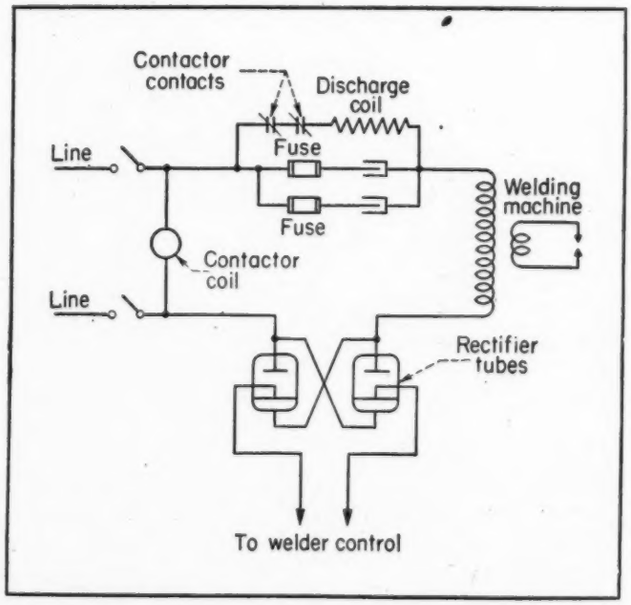


Figure 3. This shows how a series capacitor is used when a welder is wound for the correct voltage to operate with a series capacitor

tinuous voltage or heating kva. is therefore low and the capacitor operates at substantially room temperature. Therefore series capacitors usually are selected on the basis of voltage "during weld," and for a given design of capacitor this voltage is permitted to go to 50 percent above that at which the same capacitor could operate continuously. For convenience, however, series capacitors usually are rated on the continuous basis.

A series capacitor installation consists of a number of capacitor units provided with a discharge device that normally is connected in shunt with the bank by a contractor, when de-energized. Application of power to the welder energizes this contactor and keeps the discharge device disconnected while the capacitor is in use.

Voltage Rating Changes

The welder and its series capacitor constitute a combination having an over-all voltage rating that is no longer the same as the line voltage to which the welder previously was applicable, because in reducing the kva. demand the current has remained constant and the required voltage has been reduced. Therefore, when a welder is equipped with a series capacitor it is necessary to introduce a transformer to readapt it to the original line voltage.

In some instances a welder designed for use on 440 volts may be used on 220 volts after a series capacitor is added. Usually, however, the combination cannot be used without an additional transformer. An alternative is to rewind the welder so that the new combination is applicable to the circuit voltage. When a new welder is being supplied complete with a series capacitor there is, of course, no problem.

The design of the welder in all instances determines the voltage rating of the series capacitor. If the welder is designed for use on a 230-volt circuit it may be preferable to rewind it when adding series capacitors rather than add a transformer because the former plan often results in the use of higher-voltage capacitors which may cost less per kva. This factor should always be considered.

If the welder is not to be rewound, two alternatives are possible. One is to place the transformer immediately ahead of the welder, as shown in Figure 1. The other is to reduce the line voltage ahead of the series capacitor. In either event the tube control must be in series with the capacitor, so as to leave it charged. If the series capacitor is placed between the transformer and the welder, and the tube control is in the line, the capacitor will be discharged after each weld. This cannot be tolerated.

Table I. 230-Volt Line

1 Welder Power Factor	2 Capacitor Ohms (per One Welder Kva.) for Unity P.F.	3 Capacitor Volts During Weld	4 Welder Primary Volts During Weld	Capacitor Unit Data 5 Equivalent Continuous Capacitor Volts	6 Maximum Permissible Short Circuit Capacitor Volts	7 Ohms per Capacitor Unit
0.25	717.0	832	860	575	948	22.0
0.26	663.0	801	828			
0.27	612.0	767	797	515	850	17.7
0.28	566.0	738	768			
0.29	527.0	710	742	485	800	15.5
0.30	491.0	685	718	460	758	14.0
0.31	458.0	660	694			
0.32	428.0	636	672	425	700	12.0
0.33	401.0	615	652			
0.34	377.0	596	633	400	660	10.5
0.35	354.0	576	615			
0.36	333.0	558	598			
0.37	313.0	540	582			
0.38	296.0	523	566			
0.39	280.0	508	552			
0.40	265.0	493	538	330	545	8.3
0.41	250.0	478	524			
0.42	237.0	464	512			
0.43	226.0	452	501			
0.44	214.0	438	488			
0.45	204.0	427	478			
0.46	194.0	415	468			
0.47	185.0	405	458			
0.48	176.0	394	448			
0.49	168.1	383	439			
0.50	160.8	373	431			
0.51	152.6	362	422			
0.52	145.9	353	413			
0.53	139.7	344	406	230	380	7.05
0.54	133.5	335	398			
0.55	127.7	327	391			
0.56	122.4	318	384			
0.57	116.8	310	377			
0.58	111.8	302	371			
0.59	107.6	295	365			
0.60	102.8	287	359			

The arrangement shown in Figure 2 is not satisfactory if the voltage on the low side of the transformer is less than 230 volts, because of possible failure of the tube to fire properly.

The arrangement shown in Figure 1 is usually to be preferred, since it enables one to select higher-voltage capacitors and often obtain lower capacitor cost. The control tubes, however, are subjected to a higher voltage, which may in some instances favor the scheme shown in Figure 2.

Obviously, the application of series capacitors to resistance welders is not so simple as the application of shunt capacitors to ordinary low power factor loads. Since the fundamental design characteristics of the welder transformer must be known, and the tube control also is affected, the makers of both the welder and the control must be consulted.

The characteristics of the welder transformer must be known in order to select the series capacitor rating, and these data are not obtainable from the nameplate. If data on the welder power factor during weld are not available from the manufacturer, they must be obtained by tests.

It is not the purpose of this article to discuss these tests, but primarily to point out some short-cuts in computing the series capacitor once the general requirements are known.

The kva. demand during weld and the power factor are to be determined

Table II. 460-Volt Line

				Capacitor Unit Data		
1 Welder Power Factor	2 Capacitor Ohms (per One Welder Kva.) for Unity P.F.	3 Capacitor Volts During Weld	4 Welder Primary Volts During Weld	5 Equivalent Continuous Capacitor Volts	6 Maximum Permissible Short Circuit Capacitor Volts	7 Ohms per Capacitor Unit
0.25	3070	1722	1780			
0.26	2830	1652	1712	1150	1900	88.3
0.27	2615	1589	1650			
0.28	2430	1526	1590			
0.29	2250	1470	1535			
0.30	2100	1414	1482	1000	1650	66.2
0.31	1955	1362	1435			
0.32	1832	1318	1390			
0.33	1716	1272	1349	895	1478	53.0
0.34	1613	1231	1309			
0.35	1516	1191	1271	815	1345	44.2
0.36	1422	1150	1236			
0.37	1343	1118	1202	750	1238	38.0
0.38	1267	1081	1171			
0.39	1200	1051	1141	705	1164	33.1
0.40	1136	1020	1112			
0.41	1074	990	1085			
0.42	1017	962	1059			
0.43	965	933	1035	660	1090	29.4
0.44	919	908	1011			
0.45	874	844	989			
0.46	830	859	968			
0.47	791	835	947			
0.48	756	815	928	575	948	22.0
0.49	719	792	908			
0.50	686	771	890			
0.51	656	751	873	515	850	17.7
0.52	627	731	855			
0.53	598	713	840			
0.54	572	694	824	485	800	15.5
0.55	544	676	809			
0.56	523	658	795	460	758	14.0
0.57	502	643	782			
0.58	480	626	768			
0.59	459	609	754	425	700	12.0
0.60	441	594	742	400	660	10.5

when using the largest throat opening provided, with a typical welding operation. These data are required to determine the capacitor reactance ohms needed. They are needed, also, under the condition when the welder electrodes are brought into direct contact to determine the need for protecting the capacitor against over-voltage at such times, or to form a basis for selecting the voltage rating of the capacitor.

Tables I, II, and III provide a quick means of estimating the required size of a series capacitor. In these tables it has been assumed that the tube drop is 15 volts and that the duty cycle will not exceed 44 percent. Also that the during weld period will never exceed 1 minute. These assumptions apply in most cases.

Use of the tables can be more readily shown by the following example. Assume:

1. During weld kva., 350
2. During weld power factor, 42 percent
3. Kva. with electrodes contacting, 450
4. Power factor with electrodes contacting, 36 percent
5. Duty cycle, 44 percent or less
6. Line voltage, 230

Referring to Table I, at a power factor of 0.42, column 1, it is seen under column 2 that the required capacitor ohms for unity power factor are 237 per welder kva. Since the welder kva. are 350 the capacitor ohms are obtained by dividing 237 by 350, which gives 0.677 ohm.

Column 3 shows that the capacitor voltage during weld is 464. Since it is impracticable to build capacitor for every small step in voltage it is necessary to limit ratings to steps that are conveniently obtained. Therefore, certain capacitor voltage ratings are used over a limited range. This example falls within the range of a capacitor that would have a continuous rating of 330 volts (column 5) and a during weld voltage up to 150 percent of 330. or 495 volts.

More Units Needed

A 330-volt capacitor has a reactance of 8.3 ohms, as shown under column 7. A sufficient number of such capacitors must therefore be used to obtain the desired reactance of 0.677 ohms. Or,

$$8.3 \div 0.677 = 12.26$$

Round out the number of capacitor units to the next whole number, or 13. This number will make the power factor slightly lagging, rather than allow it to lead.

Column 4 shows that the welder primary must be wound for 512 volts.

Column 6 gives the maximum permissible voltage that may be allowed to appear on the series capacitor. A check must be made to determine whether this limit will be exceeded, for example, when the welder electrodes are allowed to come into direct contact.

Using the figures for requirements 3 and 4 in the foregoing example, the maximum permissible voltage may be determined as follows:

Welder short-circuit impedance = Z_{wsc}
Welder short-circuit resistance = R_{wsc}
Welder short-circuit reactance = X_{wsc}
$Z_{wsc} = E^2$ (Col. 4) $\div$ ($Kva. \times 10^3$) = $512^2 \div (450 \times 10^3) = 0.582$ ohm
$R_{wsc} = 0.582 \times 36\%$ p.f. $= 0.209$ ohm
$X_{wsc} = \sqrt{0.582^2 - 0.209^2} = 0.543$ ohm
Net reactance = $X_c - X_{wsc} = 0.677 - 0.543 = 0.135$ ohm
X_c = The reactance ohms of the series capacitor previously determined.
X_1 = Welder short-circuit net reactance determined above.
Net impedance = $\sqrt{R^2_{wsc} + X_1^2} = \sqrt{0.209^2 + 0.135^2} = 0.249$ ohm
Line current = (E − Tube drop) $\div Z$ = $(230 - 15) \div 0.249$ = 863 amperes
Capacitor voltage with electrodes = $X_c \times 863 = 0.677 \times 863 = 582$ volts shorted

(Note: No allowance is made here for drop in line voltage due to regulation. This should be taken into account in specific cases.)

In this instance the capacitor voltage reaches 582 whereas the permissible value shown under column 6, Table I

is 545 volts, which means that the voltage must be limited by some protective means, or that a capacitor must be selected with a higher continuous rating.

If a higher-voltage capacitor is selected, more units will be required. A 400-volt capacitor has a permissible voltage of 660, which is ample here. Such a unit has 10.5 ohms. Since substantially 0.677 ohms X_c total is required, the number of 400-volt capacitors needed is obtained by dividing 10.5 by 0.677 which gives 15.5 capacitor units. This may be rounded out to 16 units.

It may be more economical to use a slightly larger number of units in cases where the capacitor voltage limit is exceeded under these conditions, rather than to add accessory devices to protect the capacitor.

With a seam welder it is always desirable to select the capacitor for the voltage developed when the electrodes are shorted, rather than use additional protective devices, because the electrodes will frequently come in contact, often on every welding operation. Protective devices would interfere with the normal use of the welder.

Computing Voltage Rating

The above example assumes that the welder will be rewound to use a series capacitor, or that a new welder is being considered. If the welder is to remain unchanged, a transformer may be designed to go ahead of it, as shown in Figure 1. Then the initial values of kva. and power factor during weld, and the kva. and power factor when the electrodes are shorted must be applicable to the transformer plus the welder. The procedure is the same as described. The input side of the transformer is given under column 4 and the low side is the welder voltage rating minus the tube drop, which is 15 volts.

If the series capacitor is to be located as shown in Figure 2 its voltage rating will be lower, and may be computed using the tables, as follows:

1. Kva. of welder during weld, 350

2. Power factor during weld, 42 percent

3. Welder rating, 230 volts (To remain unchanged)

Using Table I column 2 it will be seen that 237 capacitor ohms are required per welder kva. With 350 kva. this gives 0.677 ohm total.

This value of 0.677 ohm assumes that the welder will be rewound for 512 volts, as shown in column 4, but since this is not the case, adjustment must be made for the voltage change, and the capacitor ohms reduced by the square of the voltage. That is,

$$512^2 \div (230-15)^2 = 5.67$$

$$0.677 \div 5.67 = 0.12 \text{ ohm}$$

The current flowing through this capacitor during weld will be determined by the kva. and the welder operating voltage. Or,

$$(350 \times 10^3) \div 215 = 1630 \text{ amperes.}$$

The voltage on the capacitor during weld is $1630 \times 0.12 = 195$ volts.

By inspecting Tables I, II, or III, column 3, a capacitor can be selected whose during weld operating range includes 195 volts. A 230-volt capacitor fulfills this requirement. Since a 230-volt unit has a reactance of 7.05 ohms the total number of such units required is: $7.05 \div 0.12 = 58.8$

Here is an excellent example of the objection to using a transformer on the line side of the series capacitor. A total X_c ohms, or 0.12, is needed for a during weld voltage of only 195, thus making it necessary to use 230-volt units and operate them well below their rating.

It is not practicable to build a capacitor with less insulation than used in a 230-volt unit, with the result that 59 units are required to obtain the low value of ohms needed. For this reason the arrangement used in Figure 2 should never be considered for a welder designed for 215 volts. With welders designed for 460 volts or higher the arrangement shown in Figure 2 may be practicable, and is often used to keep down the voltage on the tubes.

Table III. 575 Volt Line

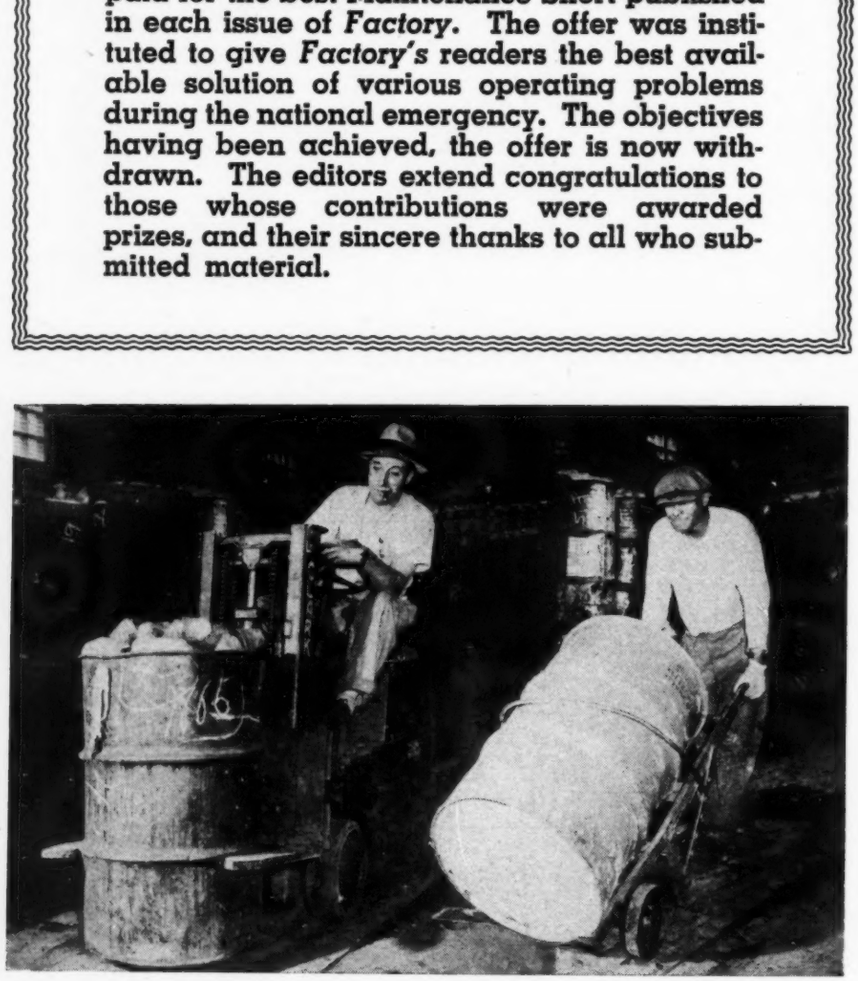
				Capacitor Unit Data		
1 Welder Power Factor	2 Capacitor Ohms (per One Welder Kva.) for Unity P.F.	3 Capacitor Volts During Weld	4 Welder Primary Volts During Weld	5 Equivalent Continuous Capacitor Volts	6 Maximum Permissible Short Circuit Capacitor Volts	7 Ohms per Capacitor Unit
0.25	4860	2170	2240			
0.26	4470	2075	2150	1630	2690	177.0
0.27	4140	1993	2070			
0.28	3840	1920	2000			
0.29	3570	1848	1930	1320	2180	118.0
0.30	3320	1780	1866			
0.31	3100	1715	1806			
0.32	2890	1657	1750	1150	1900	88.3
0.33	2710	1600	1696			
0.34	2550	1548	1646			
0.35	2390	1497	1600			
0.36	2250	1450	1555	1000	1650	66.2
0.37	2130	1406	1513			
0.38	2010	1363	1474			
0.39	1898	1322	1435			
0.40	1798	1283	1400	895	1478	53.0
0.41	1699	1245	1366			
0.42	1616	1212	1334			
0.43	1530	1175	1303	815	1345	44.2
0.44	1456	1144	1272			
0.45	1385	1112	1244	750	1238	38.0
0.46	1311	1078	1216			
0.47	1258	1055	1192			
0.48	1196	1023	1166	705	1164	33.1
0.49	1140	997	1143			
0.50	1086	970	1120			
0.51	1034	942	1097			
0.52	990	920	1077	660	1090	29.4
0.53	945	895	1056			
0.54	903	872	1037			
0.55	865	850	1018			
0.56	828	828	1000	575	948	22.0
0.57	792	807	983			
0.58	760	787	966			
0.59	726	766	949	515	850	17.7
0.60	696	747	934			

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

PLEASE TAKE NOTE

Since February, 1944, a prize of $50 has been paid for the best Maintenance Short published in each issue of *Factory*. The offer was instituted to give *Factory's* readers the best available solution of various operating problems during the national emergency. The objectives having been achieved, the offer is now withdrawn. The editors extend congratulations to those whose contributions were awarded prizes, and their sincere thanks to all who submitted material.



One fork truck with tapered fork handles 400 drumloads, 2000 pounds of metal each, in 8-hour day, compared to old hand truck method, moving less than 15 tons in same period

Special Fork Handles Drums Speedily, Safely

SOURCE: Clark Tructractor, Battle Creek, Mich.

One of the important items in the efficient operation of a scrap metal conversion business is speedy movement of the bulky raw materials. In the plant of L. S. Cohen & Company, Inc., Chicago, brass and bronze scrap in solid ingots is moved about in empty oil drums, each of which accommodates 2000 pounds. To handle these heavy drums, a fork truck is used, with the standard fork tapered so that it can safely grip the drum below its lower reinforcing rib.

Lifting them only a few inches from the floor, the truck can carry loaded drums speedily from conveyor to storage or shipping, handling 400 drumloads per 8-hour day—400 tons of metal transported by one fork truck and one operator, as compared to the old method by which one man could transport by hand truck a maximum of less than 15 tons during the same period.

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Relay in Conveyor Drive Prevents Spills

E. A. DUNNING, Superintendent, Ralston Purina Company, Wilmington, Del.

When raising grain or mill feed with a bucket elevator there is always danger of choke-ups and spills if the conveyor feeding the elevator is controlled independently. To remedy this condition a normally open relay was installed in the control circuit of the feeding conveyor, the relay being energized by the elevator motor circuit. Essentially, this relay is nothing more than a holding coil, that closes the control circuit when it is energized.

With this relay in the circuit the feeding conveyor cannot be started until the elevator is running. Conversely, the conveyor will stop the instant the elevator stops. Any material the conveyor is feeding to the elevator will be held on the conveyor.

Such relays on feeding conveyors have decreased elevator maintenance materially and entirely prevented spillage of material.

•

Avoids Lacquer Drying Flashbacks in Oven

W. E. SCOTT, Plant Engineer, Continental Can Company, Inc., Jersey City, N. J.

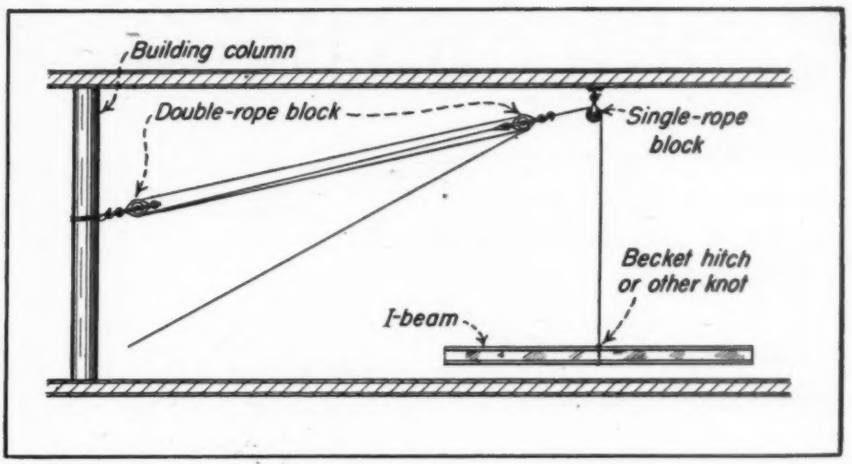
A problem arose in the department where bomb-fuse container cans were spray-lacquered and dried, because of the flammable nature of the volatile vapors given off in the drying process. The exterior surfaces of the cans were being sprayed with a lacquer specified by the government for this purpose. From the spray lacquering operation the cans passed on a belt conveyor through a gas-heated drying oven normally used in this process. Flammable vapors gradually accumulated at the top of this oven, and ignited several times. The flashbacks were not hazardous to the employees, but disrupted production while the oven was being overhauled.

Evidently no open flame could be permitted in this process. The gas flames therefore were turned off, and the heat to dry the lacquer was furnished by a series of 12 electric lamps designed for heating

purposes. These lamps were mounted in porcelain socket units and arranged in the oven to focus on the cans passing through on the conveyor.

In addition, a small blower was attached to the oven, with outlet to the outside atmosphere, and adjusted to obtain the maximum circulation of air in the oven with a minimum of cooling effect.

As a result, the lacquer drying process is now being accomplished without interruption by flashbacks. Although there has been no increase in production other than the elimination of these interruptions, it has also been noticed that the quality of drying has improved to obtain a harder and more even surface on the cans.



Hoisting Loads in Close Quarters

H. B. McDERMID, Cincinnati

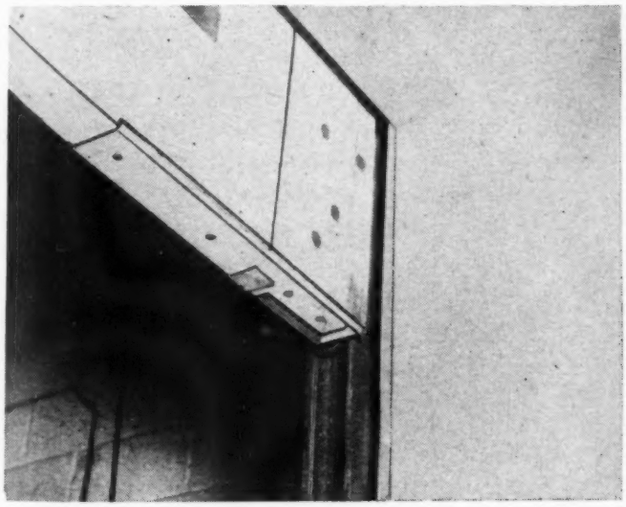
The question of the height available is one of the points that often comes up when rigging, especially in close work. After tackle has been attached to the weight to be lifted, will there be enough vertical lift to place the object where it has to go? Often there is not; the tackle takes up too much of the space available.

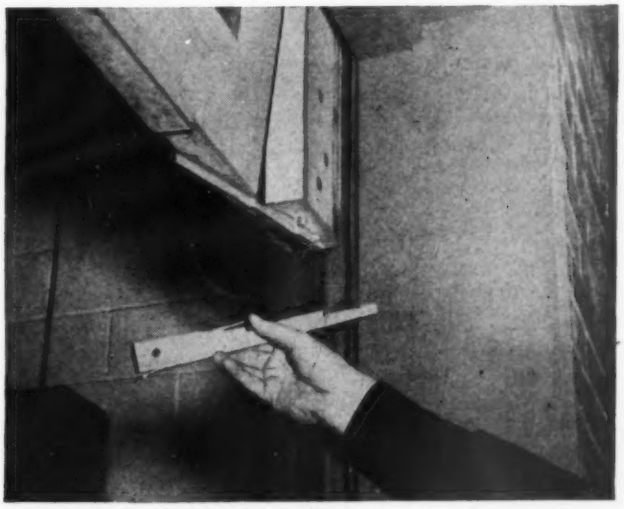
The manner in which one such problem was solved has since been used in scores of tight places.

During the erection of steel members that had to be placed close to a concrete ceiling, a contracting firm's gang boss was unable to put up some I-beams that were just too heavy to man-handle and too close to the ceiling to permit the use of the ordinary blocks for ¾-in. rope. Next day another man did the work easily in jig time.

In place of the usual two-rope blocks that had been used at first, the new man used only a 1-rope block at the ceiling. That one was as small as he could get and placed as high as he could get it. A single rope threaded through this block was attached to the beam, while a standard double-rope block was attached to the single rope on the opposite end from the load. Then all that was needed was a solid anchor to hold the second of the two double blocks sufficiently far away to give travel space.

When the power was applied up went the beam plenty high enough to land properly in its place, nearly a foot higher than the ordinary blocks would pull it. The accompanying sketch shows how this job was rigged.





Left, bottom panel of overhead door, with wood shear strip held in place by a spring clip. Right, the shear strip breaks and protects the door from injury when the bottom panel receives a hard blow from passing trucks

Shear Strips Reduce Overhead Door Repair

WILLIAM BERTLEFF, Carpenter Supervisor, Ohio Rubber Co., Willoughby, Ohio

To prevent breakage if struck by the load on a power truck, the bottom panels of overhead doors in one large plant have been hung on double-action hinges, and are kept in position by wood shear strips. The top edges of the bottom panels and the lower edges of the panel above have been beveled to allow the panel to swing both ways.

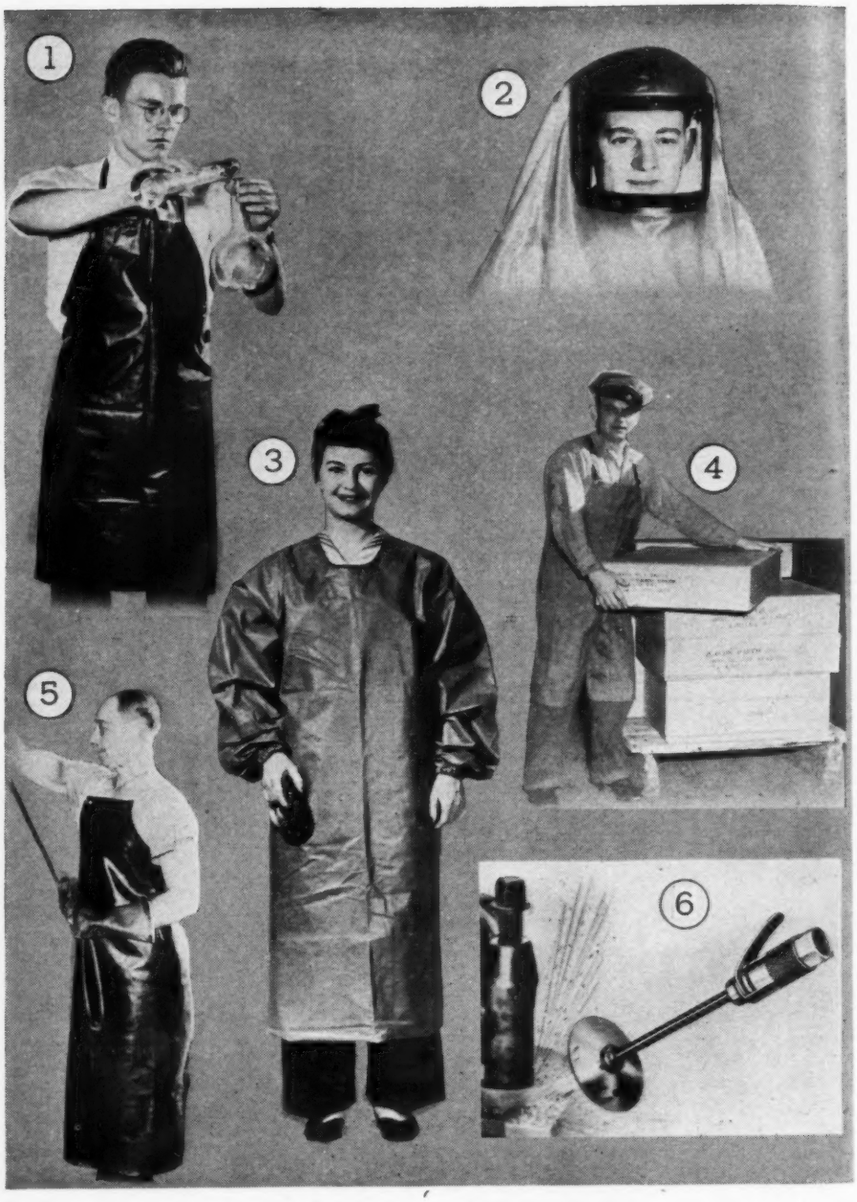
The wood shear strips are mortised into the bottom of the lower panel, to fasten it to the side rails. Metal or wood dowel pins, installed in the door, serve to fit the shear strip into place. A templet is used when drilling holes in the shear strips to insure that the strips will fit the pins. A spring steel clip is used to keep the shear strip from dropping off the pins.

If the panel is hit by a truck, the shear strips fracture and allow the panel to swing on the double-action hinges, as shown in the illustration. It is a simple, inexpensive operation to install two new shear strips to put the door back into service. Side rails of the doors are no longer bent or pulled loose from their moorings.

This simple alteration on overhead doors saves repair labor, replacement parts and materials, and a great deal of inconvenience to employees.

Health and Safety Equipment

Health and safety equipment introduced to you by *Factory* during the past 12 months is reviewed here to give you a quick one-year summary



ACID-RESISTANT APRON–Lightweight, acid-, alkali-, and oil-resistant apron is made from fabric coated on one side with a black vinyl resin. Edges are hemmed, and neck and waist tape is in one piece, sewed into hem of the arm cut-out. The B. F. Goodrich Company, Akron. (Figure 1)

ACID-RESISTANT HOOD–is reported to give chemical workers protection against concentrations of nitric, sulphuric, hydrochloric, and other acids, without deteriorating itself. Made of Asco Acitex, hood covers head, shoulders, chest, and back, tying at the waist. Chicago Eye Shield Company, Chicago. (Figure 2)

APRON–Arm and body protection, for workers in oil or acids, is claimed for apron. Made of strong, closely woven fabric coated on both sides with neoprene or polyvinol butyral. Said to have resistance to low temperature, flammability, abrasion, and reagents. Dunn-Products, Chicago. (Figure 3)

APRON–To take the place of overalls, split-leg apron, named Canpro, furnishes around-the-leg protection for handling kegs and boxes. Made from heavy O.D. water-repellent canvas, it is doubly reinforced at midsection as well as at knees, and has pockets which cannot pull loose. Canvas Products Corporation, Fond du Lac, Wis. (Figure 4)

APRON–Fabric apron features sliding snap fasteners, called Snap-Strap. The application of web straps with snaps permits easy adjustment, and apron can be instantly removed if caught in moving machinery. Impregnated with Sta-Safe Compound, and cured, aprons are claimed to protect against acids, caustics, solvents, flame, oils, and paints. Standard Safety Equipment Company, Chicago.

APRON–is of a treated fabric combined with a plastic by a calendering process, which impregnates the fabric. Said to be acid-proof throughout, and can be washed or cleaned without harm to its protective qualities. The B. F. Goodrich Company, Akron. (Figure 5)

BLANKET CASE–keeps an emergency or first aid blanket ready for use in clean, sanitary condition. It is 15x12x5 inches, and, placed flat against the wall, allows adequate passage room if mounted in an aisleway or confined area. Hinged cover opens easily and wide for quick access to blanket. Supplied with or without blanket. Universal Safety Equipment Company, Chicago.

BLOWGUN SHIELD–Adaptable to standard blowguns, transparent safety shield is designed to stop or deflect chips and flying particles scattered by air blasts in cleaning and dusting operations. Protects workers from eye injuries, but does not interfere with uses to which compressed air is applied. Shield is made of heavy-gage transparent plastic, concave-shaped. W. I. Martin & Company, Chicago. (Figure 6)

CAP–Made of dark blue cotton netting, safety cap for women protects the hair-do and at the same time gives the wearer a jaunty look. Cool for summer wear,

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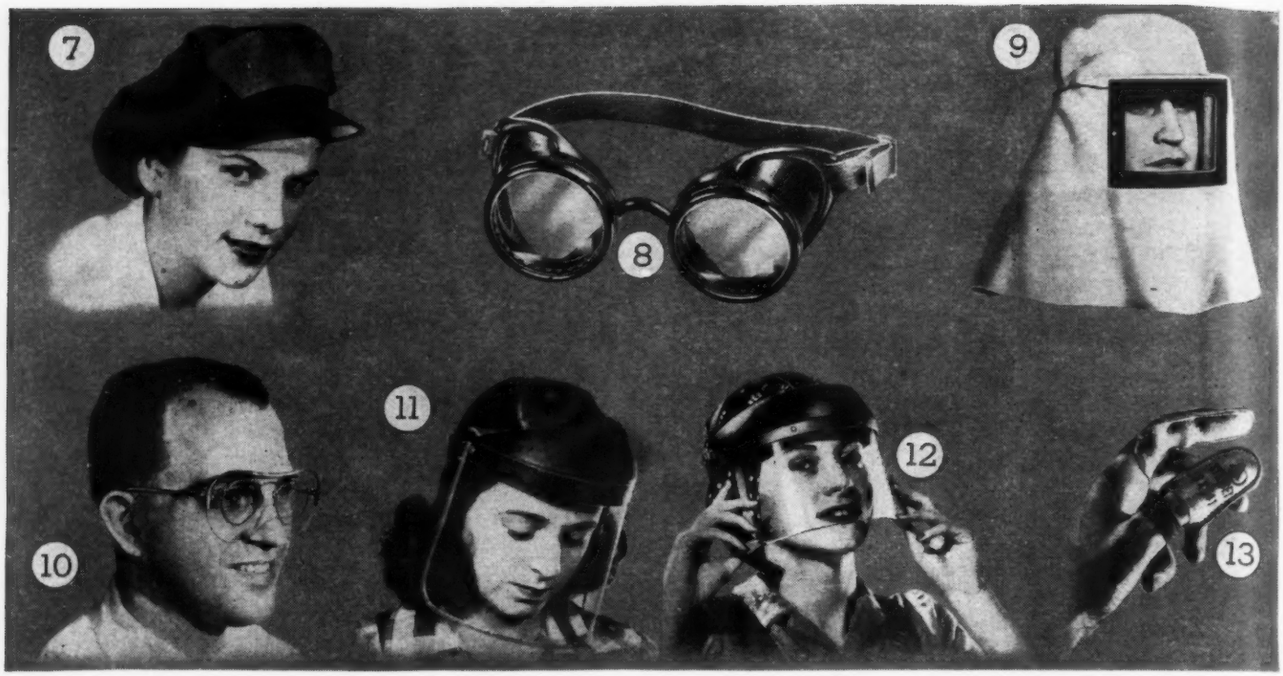

because the mesh work allows free passage of air to the scalp. Visors are said to be fire resistant. Cap is washable. Brewster Hat Company, Inc., New York. (Figure 7)

DUST GOGGLE—is equipped with acetate eyecups shaped to conform to contour of each eye. Goggles fit snugly against face to keep out dust and powder. Thin wire mesh screen on inside of side shields gives protection against fine particles. Ventilating system extends over large area to reduce fogging. American Optical Company, Southbridge, Mass. (Figure 8)

DUST HOOD—Lightweight hood is claimed to offer full vision and protection against fine nuisance dusts. Style GG-300 is constructed of cotton sheeting over a cloth cap, with 5x6-in. fiber frame window opening. Window of cellulose acetate plastic is replaceable. Industrial Products Company, Philadelphia. (Figure 9)

EYESHIELD — of plastic, weighing less than 1 ounce, is for use in semi-hazardous jobs, such as spot welding, light grinding, and woodworking. Known as FeatherSpec, it has replaceable one-piece lens gripped in suspension-lock frame. Green lens can be substituted for the clear one. Can be worn over prescription lenses. Willson Products, Inc., Reading, Pa. (Figure 10)

FACE SHIELD—Type V-1 face shield is designed for comfort and protection of face and forehead in light-duty operations, such as spot welding, light grinding, and woodworking. Fits over correction spectacles and extends well back along sides of face. Light in weight, the Protecto-Shield has adjustable headband, front cushioning with replaceable leather sweatband, back cushioning, and is of transparent Lumarith. Willson Products, Inc., Reading, Pa. (Figure 11)

FACE SHIELDS—Models F-100, F-200, F-300, and F-400 face shields provide protection for metal sawing, acid handling, buffing, sanding, and light grinding operations. Button-on windows for the shields are available in clear cellulose acetate for general purposes, 24-mesh screen for heat protection, and fiber with filter glass window for welding and scarfing. American Optical Company, Southbridge, Mass. (Figure 12)

FINGER GUARD—Protection of thumb and finger for buffing, polishing, grinding, punch press work, inspection, and other operations, is afforded by Steel-Grip Supergard No. 15249. Consists of flexible leather working face extending two-thirds around finger, with porous elastic webbing back. Industrial Gloves Company, Danville, Ill.

FINGER GUARDS—Two types of finger cots are available in small, medium, and large sizes. One of the Sta-Set cots, made from grain leather, is suitable where sensitivity of touch is a factor, such as in soldering small wire and in assembly work. The second is made from chrome tanned cowhide leather, and can be used for jobs involving hard use, such as polishing, burring, and grinding small parts. American Optical Company, Southbridge, Mass. (Figure 13)

FIRE ESCAPE—Lightweight steel portable fire escape can be placed in safety zone away from the fire hazard. Has metal yoke steps 10 inches wide by 4½ inches deep. Units are made in three lengths for use from second, third, or fourth story. Carrying capacity is 1880 pounds. Anchor is hooked over windowsill, dropping the unit in carton out of window to ground. Metal-Portable-Fire Escape Company, Grand Rapids, Mich.

FOG-FREE GOGGLE — Normal breathing provides a natural ventilating pump for the fog-free, dust-free goggle. Sweeps a complete change of air about once every second through flow channels in the frame and across inner face of the big single plastic lens. This removes moisture from within goggle before it can condense as fog or frost on lens. Air intake ports contain replaceable felt filter pads. Welsh Manufacturing Company, Providence, R. I. (Figure 14)

GAS ALARM—detects combustible gases and vapors, visually and audibly indicating their approach to the dangerous limits before a fire or explosion might occur. Automatically ventilating fans may be started, or machinery stopped. Analysis of gas takes place in

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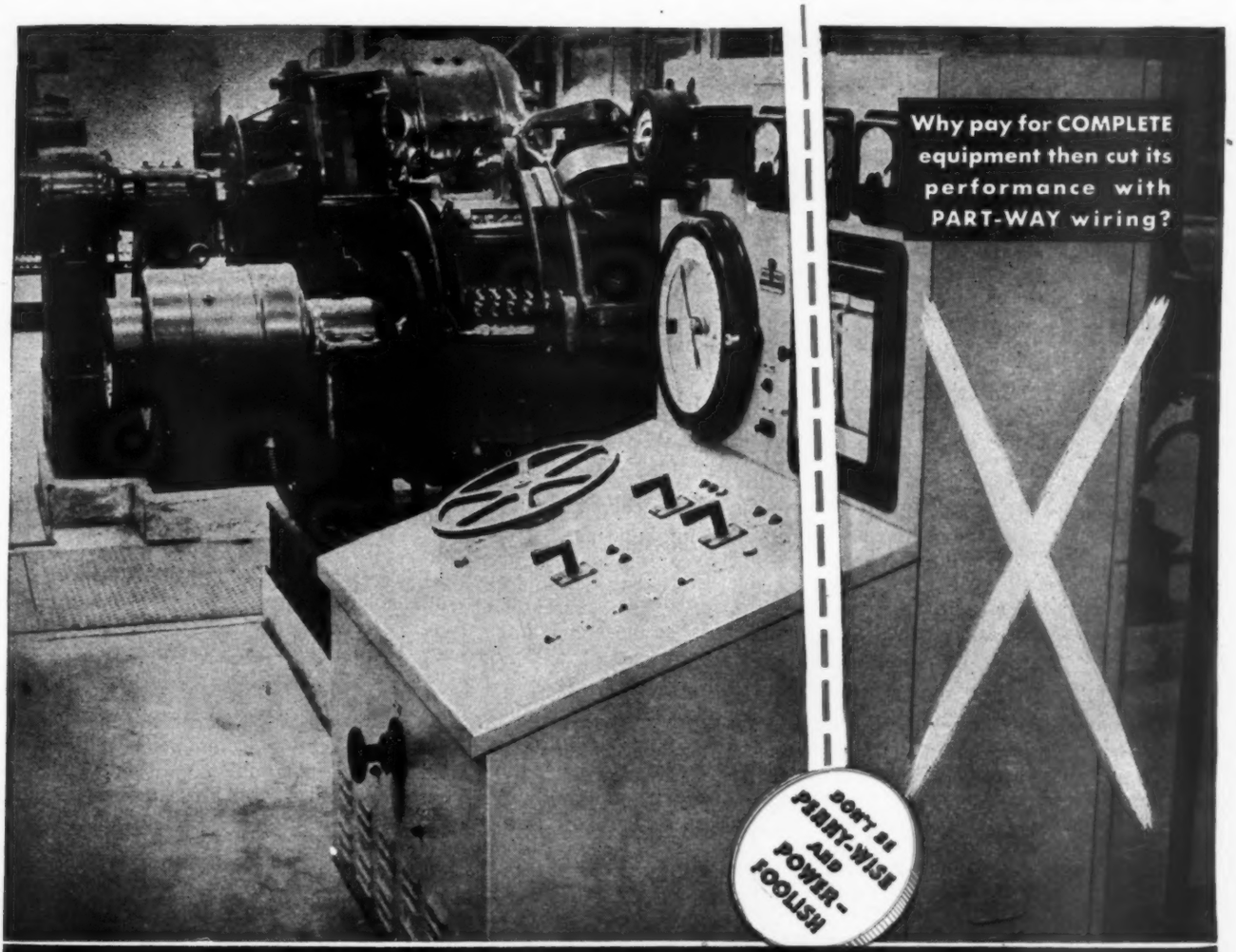
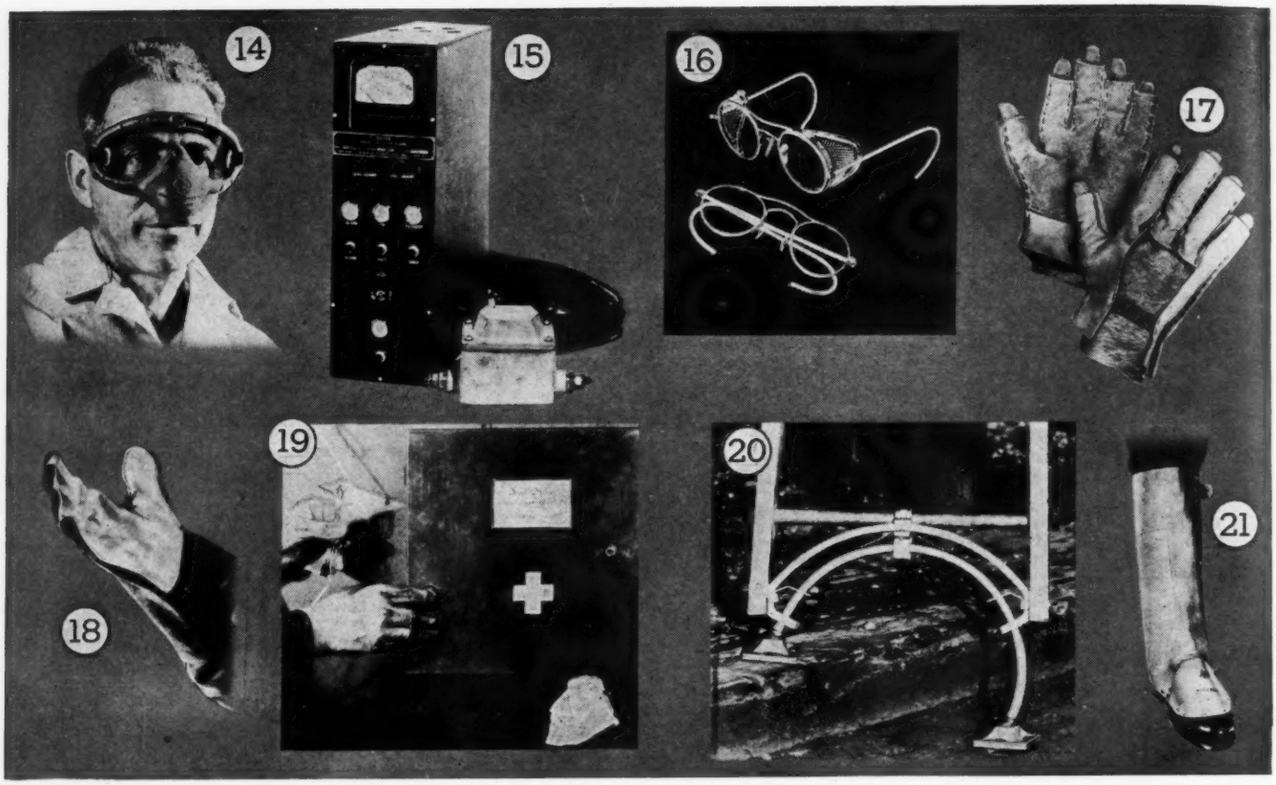


ANACONDA

ANACONDA WIRE & CABLE COMPANY



explosion-proof remote head and indication is instantaneous. Filament blowout signal indicates if any head is inoperative. Davis Emergency Equipment Company, Newark. (Figure 15)

GLASSES—provide eye protection because lenses are heat-treated, tested for impact strength and optical clarity, and frames are reinforced. Lenses may be ground to prescription. Twenty frame sizes are available, as well as 10 types of side shields. Willson Products, Inc., Reading, Pa. (Figure 16)

GLOVE FOR WIRE STRAPPERS—is of grain leather, with extra palm patch of chrome tanned cowhide. Fingers and thumbs are open at tips to increase flexibility and permit ease in picking up tape, wire, and small tools. Features open back for coolness. Sizes for men and women. Industrial Gloves Company, Danville, Ill. (Figure 17)

GLOVE—made from chrome-tanned cowhide, is suitable for welding and other heavy-duty operations. Has one-piece back construction, eliminating seams that might catch sparks or molten metal, and vulnerable seams are welted. American Optical Company, Southbridge, Mass. (Figure 18)

GOGGLE CLEANING COMPOUND—Anti-fog preparation keeps goggle lenses, face shields, and welding plates clear. The material deposits a thin film which is said to help prevent fogging, as well as to remove grease and dirt. American Optical Company, Southbridge, Mass.

GOGGLE CLEANING STATION—called Sani-Spray, is a heavy-duty steel atomizer cabinet with refillable quart jar of goggle cleaner, a supply of tissue paper, and built-in receptacle for used cleaning tissues. Apparatus is locked in cabinet. Allen Optical Company, Buffalo, N. Y. (Figure 19)

HEAD PROTECTOR—Molded fiber head protector, known as Beanie cap, is designed to guard against injuries. Cap employs a soft, flexible band that fits heads of any shape comfortably, and lining and hammock are arranged to cushion a blow. Portable Products Corporation, Pittsburgh.

LADDER-LEVELING BASE—When attached to a ladder, Shur-Foot base automatically adjusts itself to ground level and surface conditions under either foot, levels ladder, and is locked in place by ladder's weight. Stepping on ladder increases locking tension, and shifting weight does not rock the ladder. Rolen Manufacturing Company, Painesville, Ohio. (Figure 20)

LEGGING AND SPAT—providing protection for industrial workers, feature easy adjustment and quick release. Legging protects front, back, and sides of leg, from instep to knee; spat covers instep and ankle. American Optical Company, Southbridge, Mass. (Figure 21)

MACHINE TOOL GUARDS—Kleervu safety guards are transparent, allowing full view of the machine and work without hindering operation. Offer protection from sparks, metallic particles, splashing liquids. Wright-Austin Company, Detroit. (Figure 22)

MACHINE TOOL SHIELD—The Magnetic Grip-Shield consists of thick transparent sheets of plastic anchored into a horseshoe permanent magnet. Deflects flying chips, metal dust, sparks, oil, liquids, and protects machine operators without obstructing vision. Dilley Manufacturing Company, Cleveland. (Figure 23)

NON-SKID FLOORING—Plastic non-skid coating is for wood, cement, or metal floors subject to heavy wear. May be applied with brush or trowel. Said to be acid- and oil-resistant, and to withstand light trucking. Stonhard Company, Philadelphia.

OIL-ABSORBING COMPOUND—Oil-Dri (All-Purpose) absorbs oil and grease from oil-covered floors, as well as emulsions and water and soluble oil solutions. Compound is claimed to be

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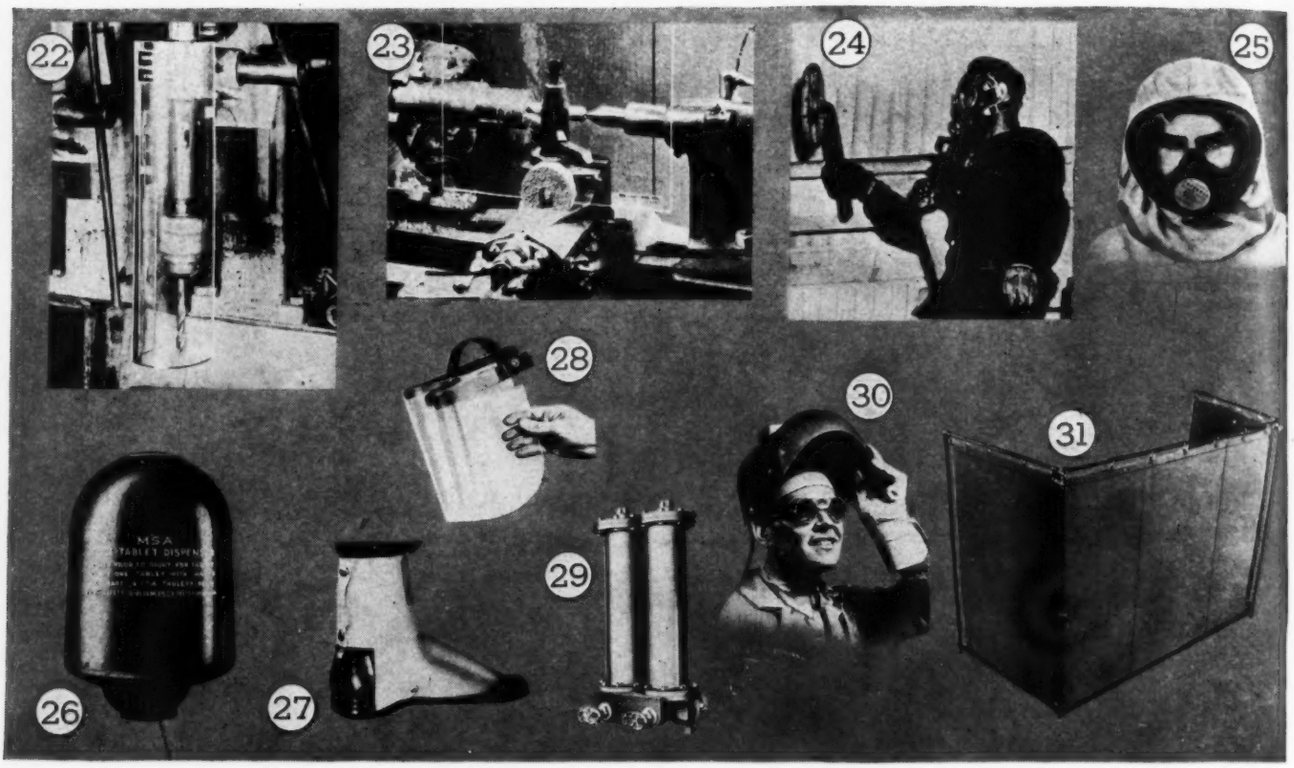


non-combustible, non-acid, non-abrasive, and harmless to hands, face, clothing, and shoes. Oil-Dri Company of America, Chicago.

RESPIRATOR—is said to provide protection against vapors in concentrations up to 1000 parts per million of such substances as acetone, alcohol, benzene, carbon tetrachloride, ether, formaldehyde, and gasoline. Equipped with twin replaceable metal filter cartridges. Mine Safety Appliances Company, Pittsburgh.

RESPIRATOR—called Air-Pak, for use with portable oxygen equipment, utilizes normal breathing air, which can be stored under pressure, in a compressed air cylinder. No chemicals are required. Has quick-connect feature. Equipped with Willson mask, which includes shatterproof lenses cushioned in rubber. Scott Aviation Corporation, Lancaster, N. Y. (Figure 24)

RESPIRATOR HOODS—are designed to give head protection on jobs and operations involving dust and spray. Made of heavy-duty 10-oz. army duck, with full-vision, heavy-gage (0.040 inch) replaceable plastic windows. Hood may be worn with or without correction glasses. Industrial Products Company, Philadelphia. (Figure 25)

SALT TABLET DISPENSER—High-pressure molded reinforced bakelite salt tablet dispenser is resistant to fracture, corrosion, and moisture. Featuring one-hand operation, it dispenses one tablet at a time with each fractional turn of knob. Has 1500-tablet capacity. Mine Safety Appliances Company, Pittsburgh. (Figure 26)

SPATS AND LEGGINGS—known as Sureseal, are made of neoprene-impregnated, lightweight, closely woven cloth. The silver-colored material protects worker from acids, caustics, solvents, oils, fats, and greases. Surety Rubber Company, Carrollton, Ohio. (Figure 27)

SWEATBAND—Absorbent sweatband, made from synthetic sponge, is for foundrymen, welders, and workers on hot jobs. By keeping moisture out of eyes and off goggles, band helps reduce possibility of accidents from blurred vision. American Optical Company, Southbridge, Mass.

VISOR—is said to simplify replacement by a snap-fast design. Perforations fit over small lugs, and spring clamps at each end hold visor in place. Made of Plastacele, visor is claimed to be non-flammable and to protect head and neck from hazards of flying particles. Chicago Eye Shield Company, Chicago. (Figure 28)

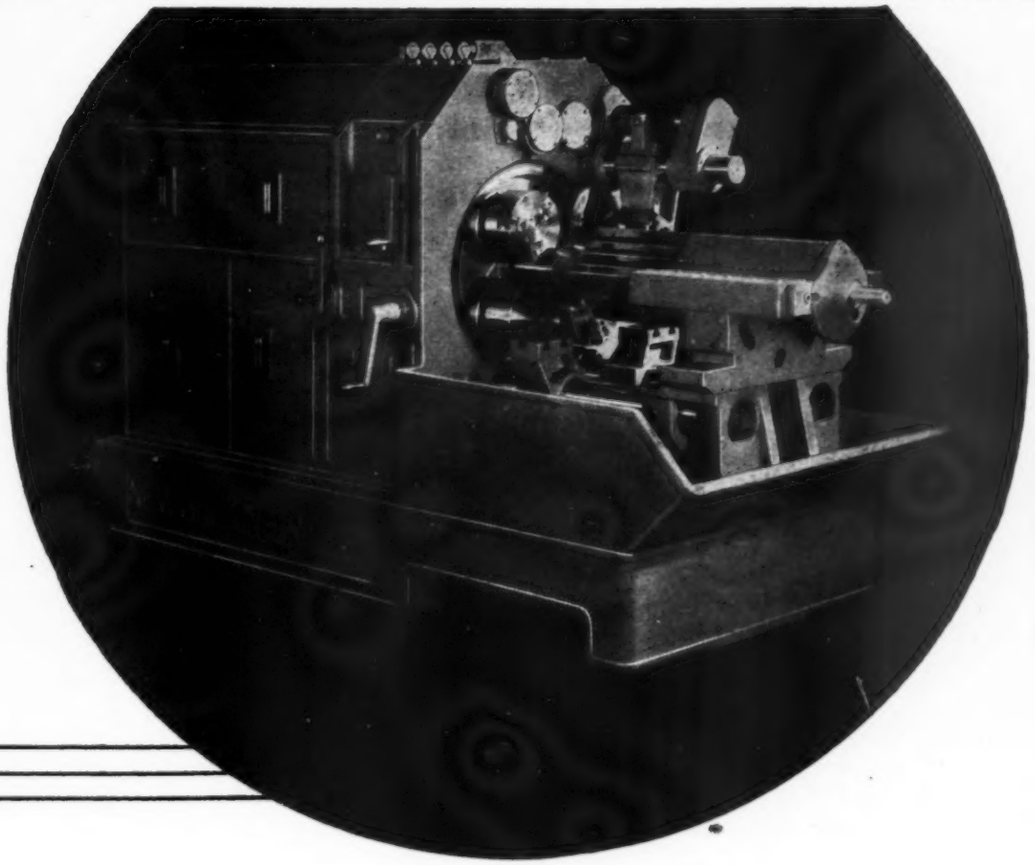
WATER FILTER—TF-1 model twin filter is a complete filter plant for applications where water must be cleaned for drinking and food purposes or for general industrial use. The filter is self-contained and self-cleaning. R. P. Adams Company, Inc., Buffalo. (Figure 29)

WELDERS' COVER GLASSES—Ipco processed, are regular glasses, 2x4¼ inches, treated with a protective coating to guard against heat breakage and damage from metal spatter. They are covered on both sides with baked-on coating which, it is claimed, will not pit, peel, or rub off. Industrial Products Company, Philadelphia.

WELDER'S HELMET—To give welders relief from obnoxious fumes, Cesco Air Flow welding helmet is claimed to reduce fatigue and improve worker morale. Fresh air is fed into the helmet through a supply tube encircling the lens holder. Constantly circulates within the helmet, preventing stale or fume-laden air from entering. Chicago Eye Shield Company, Chicago. (Figure 30)

WELDING CURTAIN—Lightweight tubular framework, with welding curtains attached, is for protection against interior, temporary hazards of welding operations. Frames can be folded for storage or for portability. Curtains are equipped with grommets and clip-type hooks for removing and changing. Universal Safety Equipment Company, Chicago. (Figure 31)

WIDE OPEN SPACES MEAN QUICK, EASY TOOLING



There are many reasons why New Britain stands first in multiple spindle automatic chucking machines . . . but none is more important than its wide open accessibility through ***open end construction*** to all tools and chucks, and convenient chip removal. More pieces per hour because no time is wasted reaching for hard-to-get-at points.

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Equalization of Piping

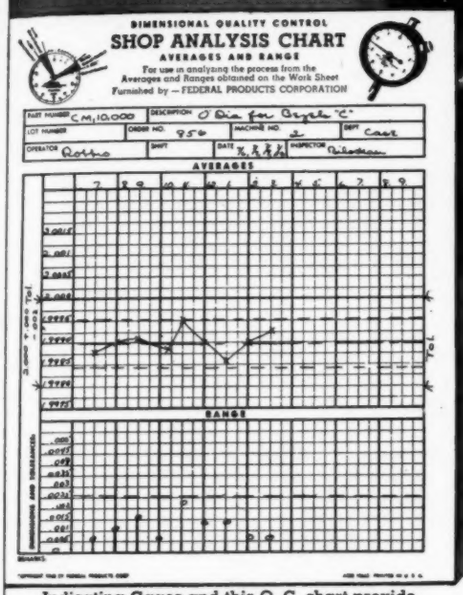
THE FOLLOWING TABLE is useful for laying out or checking the capacity of air, steam, or gas lines and ducts. It gives the number of branch lines of a given size that will equal the capacity of a given single main line, or it can be used to determine the needed size of a main line when given assorted sizes of branch lines.

Internal Diameter Inches	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
½	1.0												
¾	2.8	1.0											
1	5.7	2.1	1.0										
1¼	9.9	3.6	1.7	1.0									
1½	15.6	5.7	2.8	1.6	1.0								
2	32.0	11.7	5.7	3.2	2.1	1.0							
2½	55.9	20.3	9.9	5.7	3.6	1.7	1.0						
3	88.2	32.0	15.6	8.9	5.7	2.8	1.6	1.0					
3½	130	47.0	22.9	13.1	8.3	4.0	2.3	1.5	1.0				
4	181	65.7	32.0	18.3	11.7	5.7	3.2	2.1	1.4	1.0			
4½	243	88.2	43.0	24.6	15.6	7.6	4.3	2.8	1.9	1.3	1.0		
5	316	115	55 9	32.0	20.3	9.9	5.7	3.6	2.4	1.7	1.3	1.0	
6	499	181	88.2	50.5	32.0	15.6	8.9	5.7	3.8	2.8	2.1	1.6	1.0
7	733	266	130	74.2	47.0	22.9	13.1	8.3	5.7	4.1	3.0	2.3	1.5
8		372	181	104	65.7	32.0	18.3	11.7	7.9	5.7	4.2	3.2	2.1
9		499	243	139	88.2	43.0	24.6	15.6	10.6	7.6	5.7	4.3	2.8
10		647	316	181	115	55.9	32.0	20.3	13.8	9.9	7.4	5.7	3.6
11		823	401	229	146	70.9	40.6	25.7	17.5	12.5	9.3	7.2	4.6
12			499	286	181	88.2	50.5	32.0	21.8	15.6	11.6	8.9	5.7
13			609	348	221	108	61.7	39.1	26.6	19.0	14.2	10.9	7.1
14			733	419	266	130	74.2	47.0	32.0	22.9	17.1	13.1	8.3
15			871	499	316	154	88.2	55.9	38.0	27.2	20.3	15.6	9.9
16				585	372	181	104	65.7	44.7	32.0	23.8	18.3	11.7
18				786	499	243	139	88.2	60.0	43.0	32.0	24.6	15.6
20					647	316	181	115	78.1	55.9	41.6	32.0	20.3
22					823	401	229	146	99.1	70.9	52.8	40.6	25.7
24						499	285	181	123	88.2	65.7	50.5	32.0
26						609	348	221	151	108	80.2	61.7	39.1
28						733	419	266	181	130	96.5	74.2	47.0
30						871	499	316	215	154	115	88.2	55.9
36							786	499	339	243	181	139	88.2
42								733	499	357	266	205	130
48									697	499	372	286	181
54									936	670	499	383	243
60										871	647	499	316

(Continued on page 166)

DIMENSIONAL QUALITY CONTROL

Dimensional quality is controlled directly at the machine.


DIMENSIONAL QUALITY CONTROL
SHOP ANALYSIS CHART
AVERAGES AND RANGE
For use in analyzing the process from the Averages and Ranges obtained on the Work Sheet
Furnished by — FEDERAL PRODUCTS CORPORATION
AVERAGES
RANGE

Indicating Gages and this Q. C. chart provide the data and means to keep dimensions under control.

Economical Control at Production — a Management Tool

Federal Indicating Gages plus Quality Control Charts Make Graphic what is happening at the Machine

The case history of the application illustrated above of Quality Control by statistical methods, based on the accurate readings of the Federal Indicating Gage, shows the practical result of controlling a critical dimension of our own product.

A piece intrinsically difficult to turn, a dimension hard to maintain, and an out-of-round condition prohibited by assembly conditions. Rejects, rework and scrap ran high, unit hours low. Imperfections at this operation directly fostered inaccurate performance of the finished instrument.

After the introduction of Quality Control scrap figures dwindled by 75%. Even greater satisfaction was gained from the even flow of homogeneously dimensioned pieces coming from this operation.

With Quality Control and Federal Indicating Gages inaccuracies are discovered *before* they develop, operator interest increases, wasted time and material disappear and a product is made that renders better service to the ultimate user.

Write for the Federal Quality Control Primer, a simplified, practical way to apply Quality Control.

3 GAGING SYSTEMS

MECHANICAL

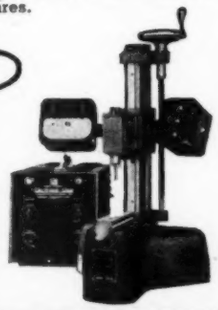
Adaptable and economical Dial Indicating Gages for the usual control requirements.

AIR

A new air System for extremely fine finishes and measurements. Many new exclusive features.

ELECTRONIC

An extremely fast, sensitive instrument with a multitude of possibilities.



FEDERAL PRODUCTS CORPORATION

1144 EDDY STREET PROVIDENCE 1, R. I.

The Federal Quality Control Primer will be mailed to anyone interested in this new management tool.

**Quality Control by Statistical Methods.*

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Tulsa • Windsor

★ ★ ★ ☆ ★ **FEDERAL** ★

PRECISION MEASURING INSTRUMENTS

Equalization of Piping *(Continued from page 164)*

When the velocities of flow in any two pipes of different sizes are equal, the volumes delivered by both lines are directly proportional to the squares of their diameters. When the head is the same, however, the velocity in the smaller pipe is less, and the volumes delivered are approximately proportional to the square roots of the fifth power of the diameters. This table is based on the latter formula.

Because of the effects of friction and viscosity, this table should not be used for piping carrying water and other liquids.

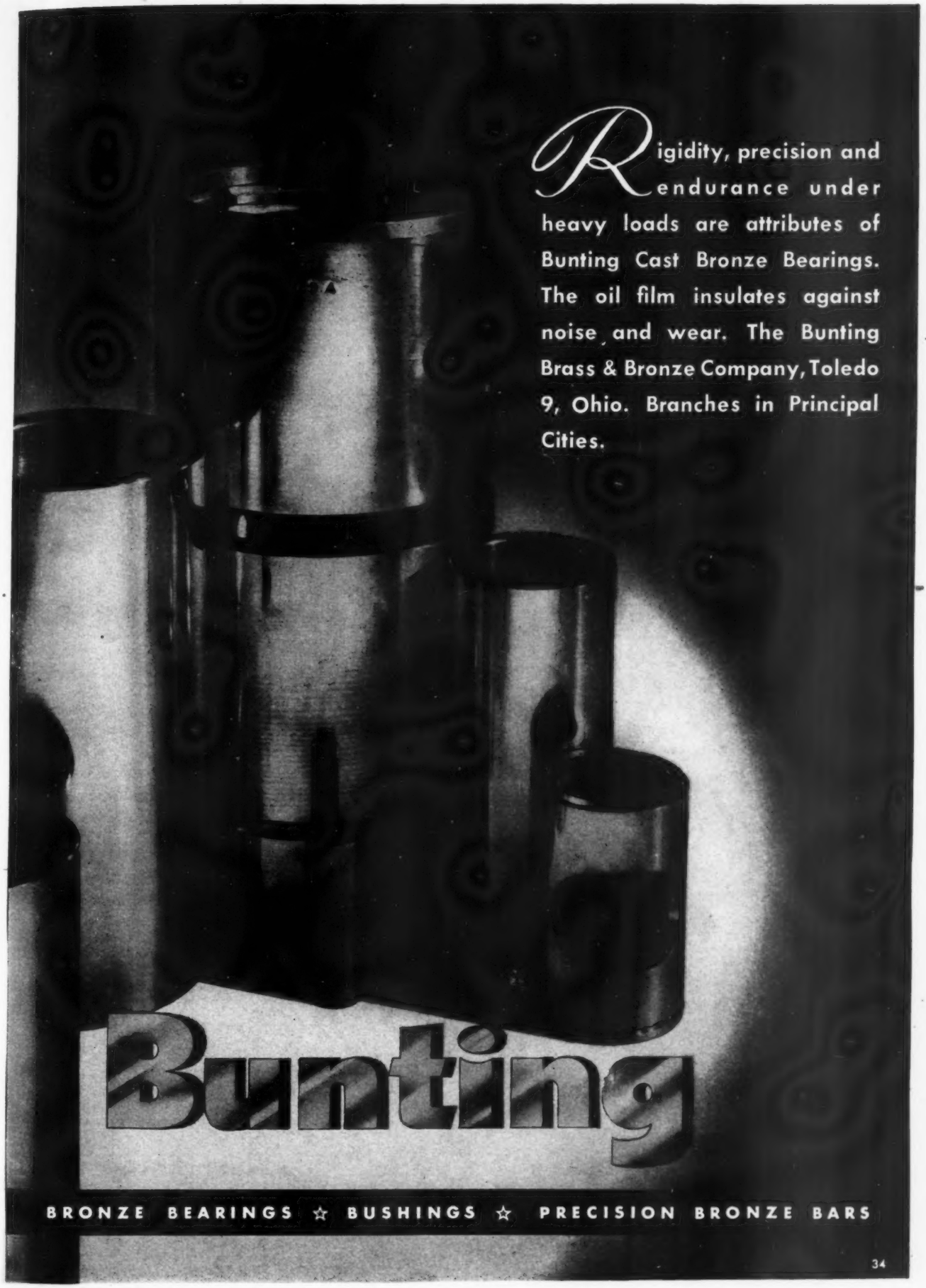
For any given size of main line (shown in the left vertical column) the number of smaller branch lines of equivalent size are shown in the same horizontal column, under the various sizes listed. For example, one 8-in. line may have 104 1¼-in. branches or 32 2-in. branches.

Often it is needed to determine the size of a main line that will serve a given number of branch lines of known sizes. The procedure is as follows: Select the vertical column in the table that is headed by the size of the smallest branch line to be served. From this column find and tabulate the relative capacity for each branch line involved, which is obtained by cross-reference to its size in the left index column.

The sum of all relative capacities thus derived represents the needed relative capacity of the main line. To translate this capacity into size, select in the left index column the size whose relative capacity as found in the same vertical column used before equals or most nearly exceeds the calculated needed capacity.

For example, what must be the size of a main line to supply six 1-in. branches, four 1¼-in. branches, and seven 2-in. branches? From the vertical column headed 1 (smallest branch involved) obtain the relative capacities for each of these branch sizes, which are 1.0 (1 inch), 1.7 (1¼ inch), and 5.7 (2 inches). The total relative capacity is then calculated as 6 times 1.0, plus 4 times 1.7, plus 7 times 5.7, which is 52.7. The value nearest to this, in the column headed 1, is 55.9, indicating that a 5-in. main line should satisfy the requirements.

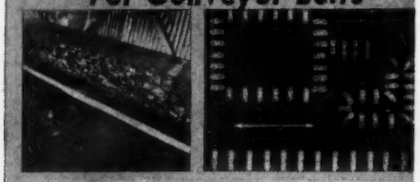
Internal Diameter Inches	7	8	9	10	11	12	13	14	15	16	18	20	22	24
7	1.0													
8	1.4	1.0												
9	1.9	1.3	1.0											
10	2.4	1.7	1.3	1.0										
11	3.1	2.2	1.7	1.3	1.0									
12	3.8	2.8	2.1	1.6	1.2	1.0								
13	4.7	3.4	2.5	1.9	1.5	1.2	1.0							
14	5.7	4.1	3.0	2.3	1.8	1.5	1.2	1.0						
15	6.7	4.8	3.6	2.8	2.2	1.7	1.4	1.2	1.0					
16	7.9	5.7	4.2	3.2	2.6	2.1	1.7	1.4	1.2	1.0				
18	10.6	7.6	5.7	4.3	3.4	2.8	2.3	1.9	1.6	1.3	1.0			
20	13.8	9.9	7.4	5.7	4.5	3.6	2.9	2.4	2.1	1.7	1.3	1.0		
22	17.5	12.5	9.3	7.2	5.7	4.6	3.7	3.1	2.6	2.2	1.7	1.3	1.0	
24	21.8	15.6	11.6	8.9	7.0	5.7	4.6	3.8	3.2	2.8	2.1	1.6	1.2	1.0
26	26.6	19.0	14.2	10.9	8.6	7.1	5.7	4.7	4.0	3.4	2.5	1.9	1.5	1.2
28	32.0	22.9	17.1	13.1	10.4	8.3	6.8	5.7	4.8	4.1	3.0	2.3	1.8	1.5
30	38.0	27.2	20.3	15.6	12.3	9.9	8.1	6.7	5.7	4.8	3.6	2.8	2.2	1.7
36	60.0	43.0	32.0	24.6	19.4	15.6	12.8	10.6	8.9	7.6	5.7	4.3	3.4	2.8
42	88.2	63.2	47.0	36.2	28.5	19.0	18.8	15.6	13.1	11.2	8.3	6.4	5.0	4.1
48	123	88.2	65.7	50.5	39.8	32.0	26.2	21.8	18.3	15.6	11.6	8.9	7.0	5.7
59	165	118	88.2	67.8	53.5	43.0	35.2	29.2	24.6	20.9	15.6	12.0	9.4	7.6
60	215	154	115	88.2	69.4	55.9	45.8	38.0	31.9	27.2	20.3	15.6	12.3	9.9


Rigidity, precision and endurance under heavy loads are attributes of Bunting Cast Bronze Bearings. The oil film insulates against noise and wear. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Branches in Principal Cities.
Bunting
BRONZE BEARINGS ☆ BUSHINGS ☆ PRECISION BRONZE BARS
34

Present Day Practice in Belt Fastening

Every man who has anything to do with the purchase, application or maintenance of conveyor, transmission or V-belts will find the bulletins listed below of considerable value in connection with belt fastening work. A knowledge of present day practice in belt fastening helps reduce the loss in machine hours due to belt failures caused by the use of the wrong type of fastener or improper application. We shall be glad to send any or all of them to you or to any of the men in your organization.

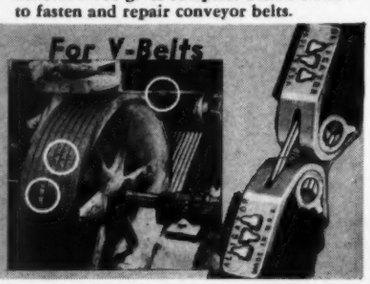
For Conveyor Belts



FLEXCO HD Belt Fasteners are used to make a "water-tight" butt joint in conveyor belts ranging from ¼" to 1½" thick and of any width. The view on the right shows the various types of rips and patches that can be made with these fasteners and Flexco HD Rip Plates.

Bulletin F-100 gives complete details on how to fasten and repair conveyor belts.

For V-Belts



ALLIGATOR V-Belt Fasteners are now being widely used to fasten B, C and D, open-end V-belting of cross woven fabric core construction now being made by most belting manufacturers. The view at the left shows a typical application of these fasteners to a drive where endless V-belts would require dismantling the machinery to put the belts on the sheaves.

Bulletin V-205 gives complete instructions on how to use V-belt fasteners.

FLEX V Fasteners for A and B belts are also available for lighter duty V-belt drives. Ask for **Bulletin V-14.**

For Transmission Belts

ALLIGATOR Steel Belt Lacing is in world-wide use to make smooth, flexible joints in leather, rubber, balata, stitched canvas or solid woven belts up to ⅛" thick and as wide as they come.

Bulletin A-60 tells how to fasten and repair transmission belts.

Sold by Supply Houses Everywhere

FLEXIBLE STEEL LACING COMPANY
4678 Lexington Street, Chicago 44, Ill.

WHAT'S NEW IN EQUIPMENT

Automatic Gas Gun

Gas gun is a self-lighting, self-extinguishing acetylene torch. The gas ignites with pull of trigger, and extinguishes on its release. Self-extinguishing feature eliminates fire hazards caused by torches left burning between operations. Balanced pistol grip makes gun easy to handle, reducing fatigue, manufacturer says. Variations in flame, with

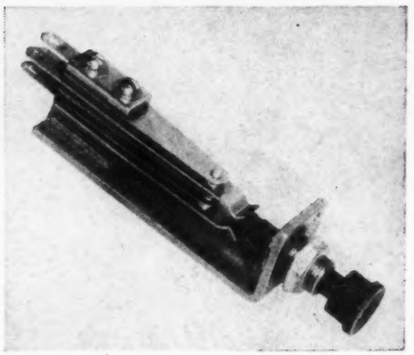
temperature range of from 950 to approximately 2000 deg. F., are obtained by adjusting pressure regulator. Device is suitable for soldering, silver-soldering, fine, light brazing, and lead burning, as well as aluminum soldering, sheet-metal work, low-temperature welding, tinning, paint removing, and general equipment repair work. Century Aircraft Co., 5601 West Century Blvd., Inglewood, Calif.

Portable Conveyor

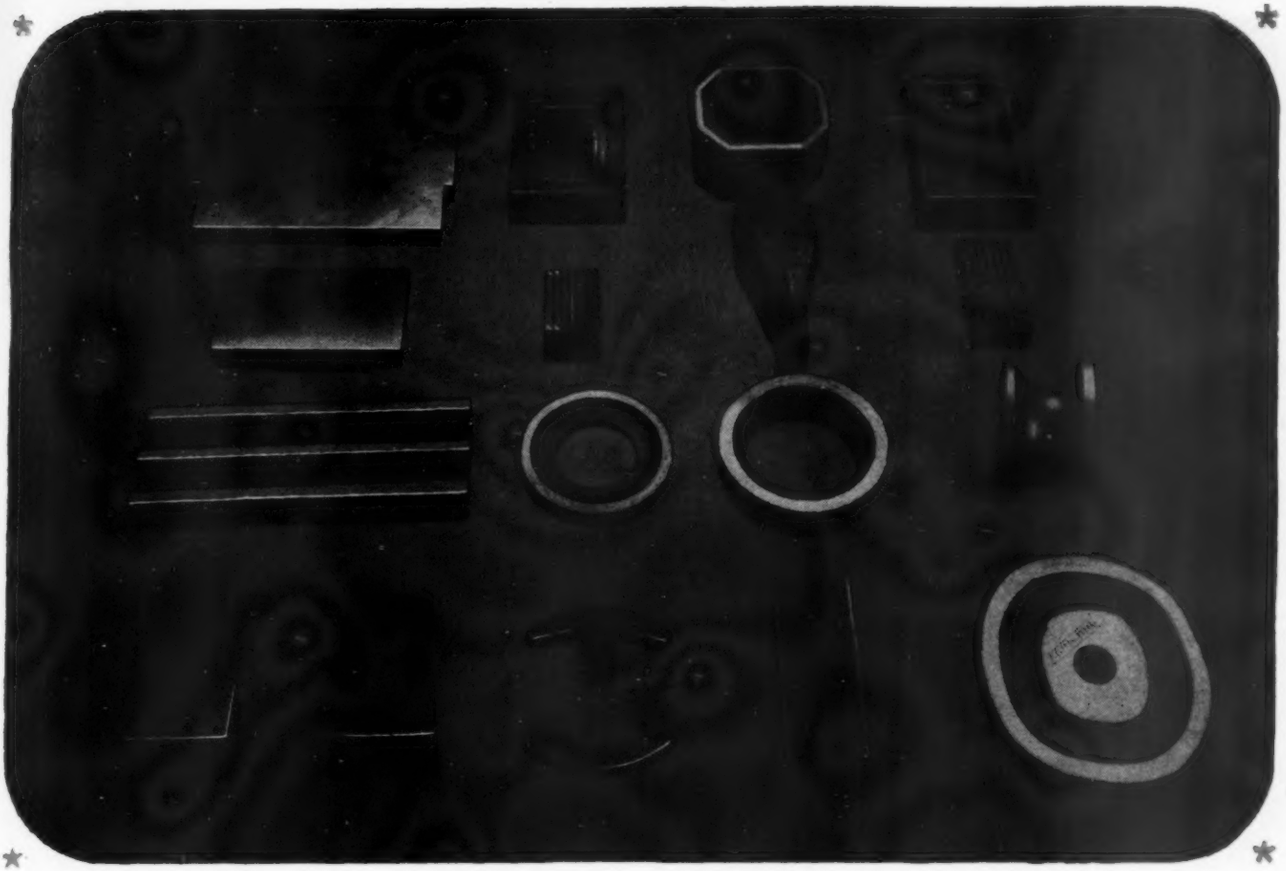
The Handibelt is an all-purpose portable belt conveyor for carrying bags, boxes, crates, cartons, and other commodities. It is adjustable to inclined, declined, or horizontal positions, and can carry products wider than the belt. Has capacity for 110-lb. bags or boxes, or a continuous load of 20 pounds per foot. As a horizontal conveyor, it can be used as an individual unit to reach from one fixed position to another, as a connecting link between other conveyors, or as a feeder conveyor. Any number of the units can be placed to form a continuous line to reach remote storage spaces. One person can move the machine into positions. Standard Conveyor Co., North St. Paul 9, Minn.

Push Switches

Series 5300 standard-duty, and 5300X extra-heavy-duty push and plug jack switches are for circuits carrying heavier currents than usually found in communication and signal systems. Adaptable to test panels, instruments, meter circuits, and similar applications, they can handle heavier currents and



require less panel space than the Series 4300 and 4400 push and jack switches. The standard-duty switch is available in 5 amperes, 115 volts, a.c. (non-inductive), and the extra-heavy-duty in 10 amperes. Built with 1 Form C., "make-break," and 1 Form B, "break," locking, it is also available in a non-locking position. Both are heavily



START WITH YOUR JOB *Half Finished*

WRITE FOR THIS BOOKLET

It contains details of FCC Tool Steels *Cast-To-Shape* and of other important Forging and Casting Division specialties that may offer you money-saving production ideas. Get your copy—write for it today.

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WHEN it's dies you're making—small or large—or various other forming tools or gages or certain fast-wearing parts of machines, FCC Tool Steel *Cast-To-Shape* can really save you money.

Very intricate shapes can now be cast in one piece within an eighth-inch of finished size. This means that you pay for less steel to begin with, and reduce machining time substantially.

Air Hardening, Oil Hardening and special Hot Work Tool Steels of various grades—each a thoroughly dependable performer in its class—are promptly available in this modern, economical form.

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Mathews

GRAVITY ROLLER CONVEYERS

Engineered to serve Production

Gravity Roller Conveyers are probably the most economical and the most commonly applied among all types of conveying equipment. The rollers are available in various diameters and capacities, and can be spaced at various centers in a number of different types of frames. The materials can be conveyed at right angles by the application of 90° Curves, or, as illustrated, Ball Transfer tables. Switches, frog sections, and hinges are common accessories. There is a Mathews Engineer operating in your vicinity. Ask him about Mathews Gravity Roller Conveyers, and the many other types of Mathews Conveyers which are engineered to serve production. Write or wire today.

MATHEWS CONVEYER COMPANY
ELLWOOD CITY, PENNSYLVANIA
SAN FRANCISCO, CAL. • PORT HOPE, ONT.
ENGINEERING OFFICES IN PRINCIPAL CITIES

nickel plated and have phosphor bronze springs with fine silver contacts, plungers of hard rubber, and red or black plastic knobs which are fastened to the plunger with nickel-plated setscrew. Donald P. Mossman, Inc., 612 N. Michigan Ave., Chicago 11.

Oxygen Mask

Chemox breathing apparatus generates its own oxygen, giving the wearer one-hour protection in unbreathable air. Designed to meet any emergency where high concentrations of poisonous gas or oxygen deficiencies are encountered. Chemical combination in replaceable canister creates oxygen by merely

breathing into it, removing carbon dioxide from exhaled breath. Equipment weighs 13¼ pounds complete. Has no cylinders, high-pressure valves, or fittings. Can be worn and operated without special training. Before canister is exhausted, a pre-set alarm bell rings a warning. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh.

Paving Breaker

Nose-end arrangement in self-contained, portable gasoline hammer paving breaker has been redesigned to utilize the resiliency of a spring-tool retaining clip. This arrangement is said to provide easy spring action of the tool itself when used at maximum overtravel, to be a quick, easy method of changing tools used in the hammer, and to eliminate broken latches and nose castings caused by inflexibility in retaining arrangement. The Syntron Co., 480 Lexington Ave., Homer City, Pa.

Work Tables

Two adjustable work tables, a tilt-top work table and a drafting table, have been developed. They are designed to provide maximum utility, comfort, and increased efficiency. The height of the work table may be adjusted from 28¼ to 38¼ inches, from a level position to any angle up to 20 degrees, for comfort of the operator in a sitting or standing position. Adjustment is controlled

YOU CAN DO SO MANY JOBS SO MUCH BETTER WITH

VARIABLE SPEED

On many applications of material handling, processing and conveying equipment; mixers and agitators; welding positioners; machine tool drives; testing and calibrating equipment . . . to name only a few . . . variable speed operation makes a tremendous improvement in the quality of the product and the quantity of production as well.

For example, look at the installation below. Looks like an ordinary lathe, doesn't it? It's a lathe all right, but not ordinary. On it can be cut all sorts of fantastic shapes, but to do this, variable speed operation is absolutely essential.

Look, too, at the Master Speedranger chosen to supply the variable speed for this job. This steel on steel, mechanical variable speed drive is built into an integral construction with the motor to form an extremely compact power package. Only one unit to order, one unit to install . . . saves time, space, money. Its all-metal construction insures long, trouble-free service and unvarying performance over the years. It will furnish variable speeds ranging up to 15 to 1 . . . as high as 5000 RPM, as low as fractions of RPM.

Speedrangers are available in an enormous range of types which makes it easy to select the right combination of features for each job. See what a really remarkable job they can do for you.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

MASTER SPEEDRANGERS

Sensitive Scales
LOOK WHAT THEY DO!

Model #66-02—Capacity . . . 6 lbs.—Sensitivity . . . 1/64 oz.—Ratio . . . 1:1, 10:1 and 50:1—Shipping Weight, 60 lbs.

Model #1743—Capacity . . . 200 lbs.—Ratio . . . 50:1 (and special tray for odd counts)—Beam . . . 5 lbs. x 1/2 oz.—Shipping Weight . . . 87 lbs.

- REVEAL SHORTAGES
- PROVIDE QUICK, CORRECT INVENTORY
- ASSURE PERFECT COUNT OF KNOWN AND UNKNOWN QUANTITIES
- CHECK DAILY PRODUCTION
- SAVE LABOR TIME
- REDUCE PARTS AND MATERIALS HANDLING
- HELP MAINTAIN PERPETUAL INVENTORY
- HELP DETERMINE PIECE-WORK PAYMENTS
- HELP IN JOB EVALUATION

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DETECTO SCALES INC.

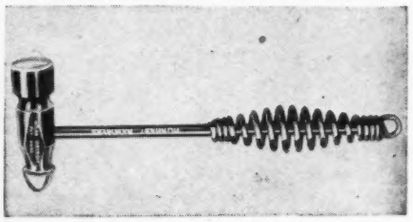
202 MAIN STREET BROOKLYN 1, N. Y.

SCALE ENGINEERS IN ALL PRINCIPAL CITIES

by a small crank conveniently located at front of table. Top is removable. Drafting table can be adjusted in height and angle. Storage space is provided for three extra boards so that several working layouts may be kept intact at once, and can be interchanged without inconvenience or loss of time. Drafting table is also equipped with large drawers for working materials. Both tables are finished in dull green. Work-Flow Equipment Co., 207 Penn Ave., Pittsburgh 21.

Metal Hammers

All-metal ball-pein hammers are said to incorporate prolonged life, safety, and perfect, dynamic balance. Heads are of alloy tool steel, flame hardened for toughness. Several models are available in different sizes. Flex-O Handgrip, shaped to fit the



hand, absorbs shock of hammer blows. All-steel handle is unbreakable, will not burn, split, or come loose from hammer head, because there are no wedges to come out, maker says. Atlas Welding Accessories Co., 14824 Wyoming Ave., Detroit 21.

Overload and Jamming Relays

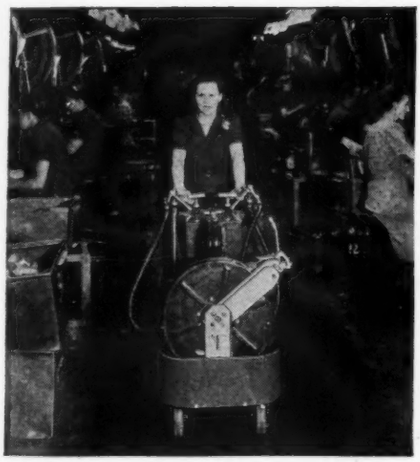
Claimed to provide almost instantaneous magnetic overload protection on general purpose and mill motor applications, and to prevent damage to hoist, windlass, and capstan equipment when the load or cable jams, AYJ relay for d.c. operation is announced. The single-break, normally closed main contacts and the double-break auxiliary contacts are suitable for carrying 5 amperes continuously, and for interrupting a d.c. inductive coil lead of 150-va. maximum. Relays are operated by a series of copper strap-wound type of coil for currents ranging from approximately 75 to 625 amperes. The coils and auxiliary contact parts are insu-

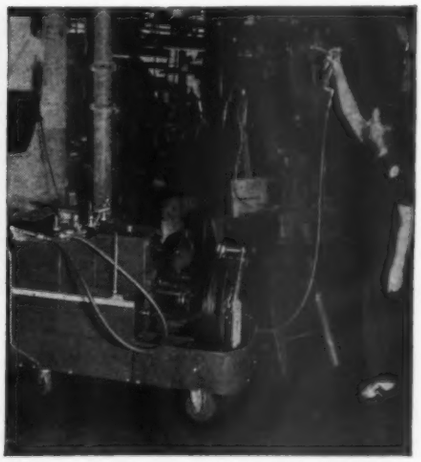
A TEN-STRIKE!

Complete Portable Lubrication Department with New Electric High Pressure Pump

● Without exception, this new Alemite Lubrikart for industry is one of the most popular Alemite developments in a decade.

Here again is a typical example of how Alemite anticipates the needs of industry in meeting lubrication problems. For it is Alemite, and *only* Alemite, that provides the big 3 of lubrication—lubricants, lubricating equipment and methods of application—the prime requisites for safe, economical, positive lubrication. Alemite, 1870 Diversey Parkway, Chicago 14, Illinois.





Pushed like a perambulator, the new Alemite Lubrikart is designed for one person operation. Dimensions: 21" wide, 55¼" long, 39" high. Mounted on five-inch Bassick ball bearing casters. It is able to travel between rows of machines or anywhere in a plant where space is limited. It saves time because of less frequent returns to the oil storage room by the oiler.

High pressure lubrication is made available by simply plugging in the electric cord. The high pressure hose and electric cord are mounted on automatic spring return reels which permit freedom of operation 20 feet in any direction. The unit is also equipped with hand operated equipment for servicing hydraulic systems, oil reservoirs, gear housings and for filling oil cans and grease guns.

Positive lubrication is assured, neglect is ended because proper lubricants and equipment are brought to the point of use. The electric high pressure pump develops 4500 lbs. grease pressure. Other equipment includes hose reel, hose and hydraulic coupler; gear lube and oil containers; compartments for oil cans; space for fittings, tools, waste, etc. Write for complete details.

ALEMITE

Another Product of STEWART WARNER

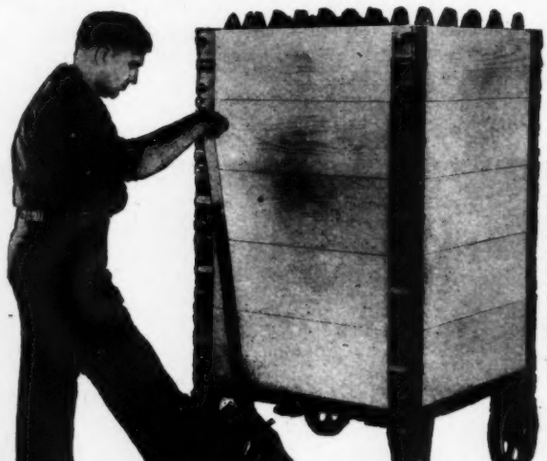
ONLY ALEMITE COMBINES ALL 3 IN LUBRICATION • 1. LUBRICANTS 2. EQUIPMENT 3. PROCEDURE

These Units CAN and DO cut costs up to 50%

Portable Slide Shelf Rack saves labor in handling small parts.

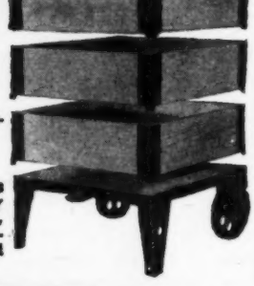
Your Savings Start Immediately with

THE TURNER SYSTEM
OF MATERIALS HANDLING



With the TURNER SYSTEM you have every Bin, Shelf and Box in your plant STANDARDIZED, INTERCHANGEABLE and MOVABLE. Immediately you have flexible factory facilities which make your almost continuous plant rearrangement problems practically solve themselves.

But more than that — you have equipment which cuts TIME and LABOR COSTS in every operation where it is used—equipment which will last indefinitely and fit into almost every handling and storing process. The TURNER SYSTEM has cut labor, space and equipment costs up to 50% for many American manufacturers.



Loaded Transports are easily moved with the Jimmy. Bin Sections are added or removed as required (right).

"Deliver the Bin and Save the Handling"

TURNER SYSTEM Bins are increased or reduced in size as needed. They are all on movable Transports — always ready to go where you want them . . . as are other Turner Units, including Shelves, Racks, Die Tables and special Superstructures. All are co-ordinated into an amazingly practical system for vertical and horizontal extension.

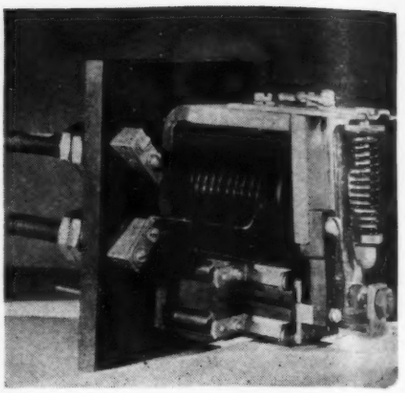
Learn About the Turner System at No Cost to You!

If you haven't already received your copy of the twenty-page book on the TURNER SYSTEM, write for it on your letterhead. If you'd like to prove without cost to yourself, in your own plant, the value of the TURNER SYSTEM, ask for details of the 60 DAY FREE TRIAL PLAN. NO OBLIGATION.

Transport with Floor Plate provides point contact with hot materials. Non-skid embossments hold materials on deck.

FACTORY SERVICE COMPANY

4605 N. TWENTY-FIRST STREET MILWAUKEE 9, WISCONSIN



lated from the relay frames for 600 volts. Ground armature and frame surfaces are plated with hard chromium for protection against corrosion and wear. Westinghouse Electric Corp., Pittsburgh 30.

Light Bulb

White light bulb is treated to diffuse central glare point caused by the concentrated filament. This is said to break up the direct raw light rays into millions of softer counter diffusing rays that glow evenly over the

entire bulb surface, without sacrifice of visible illumination. Ten sizes, from 10 to 200 watts, are made in 115, 120, and 125 volts. with four sizes, from 25 to 150 watts, in 220, 230, 240, and 250 volts. Wabash Appliance Corp., 345 Carroll St., Brooklyn 31, N. Y.

Hacksaw Blade Holder

Designed to aid utilization of broken lengths of hacksaw blades and thin flat file sections, the "Super" blade holder is announced. Holder is a single unit tool composed of tubular handle with extended positive grip nose, to secure working point of blade or file. Ends of handle are slotted to receive inserted blades of different lengths. Can be

★

CONTRACT MANUFACTURING

...as an Industry Policy

Industry has always purchased functional parts such as carburetors, fractional motors and such from other makers. But it took the war to spread the practice of contracting the manufacture of special assemblies.

Speed was the emphasis then, and cost was secondary. But with reconversion, cost reassumes its normal importance.

Speed and Economy Can Team Up!

Like hundreds of others we did our share of manufacture for others during the war—perhaps we got more than our share. In looking for the reason, perhaps there's something to the idea that we've been at this contract manufacturing business for more than 50 years. Just by the law of averages, we ought to know the business.

And since ours was not a war baby fed on the easy cost-plus formula, we should also be able to cut a few corners on costs too. For we were brought up with a stop-watch in one hand, a finely sharpened pencil in the other—and a group of hard-boiled cost-minded peace-time primes looking over our shoulder.

Why not "Call our Bluff" (?)

Maybe we can show *you* something on costs that will cause you to contract some of those assemblies you were planning to make yourself. Maybe we can do it just as fast (maybe faster) and save you a lot of headaches, labor and equipment problems.

Why not check us on the possibilities in this suggestion? It won't cost you anything to look into it with us—and it may save you both time and money.

★ ★ ★

Write on your business stationery for 48-page book, "Let Lewyt Do It"—the story of the Lewyt organization in pictures. Lewyt Corporation, 82 Broadway, Brooklyn 11, N. Y.

ARMY E NAVY

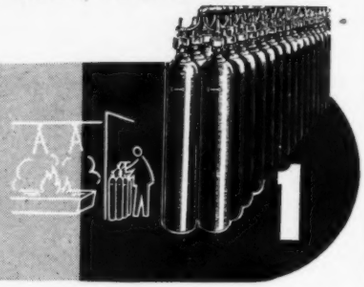
Lewyt

BUY VICTORY BONDS

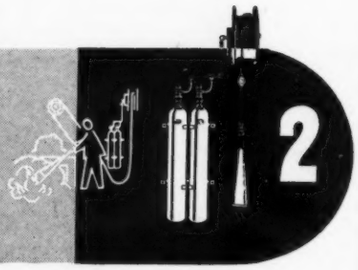
FOR MORE THAN 50 YEARS A CONTRACT MANUFACTURER ... EXPERTLY STAFFED TO PRODUCE COMPLETE ELECTRONIC AND MECHANICAL ASSEMBLIES, COMPONENT PARTS, SUB-ASSEMBLIES AND METAL PRODUCTS TO THE MOST EXACTING REQUIREMENTS

C-O-Two
MAKES FOUR POINTS FOR THE RECORD

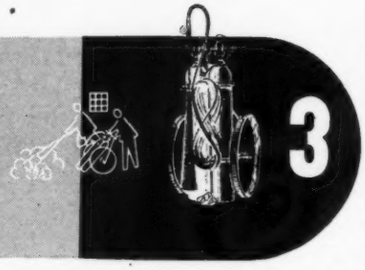
INSTANT ACTION against fire with the original C-O-TWO pressure-operated type, built-in system. Engineered to protect one or several spaces, electrical equipment, paint, oil, lacquer, alcohol and other highly flammable liquids and stored materials. Operated in combination with smoke detector and thermostat controls.



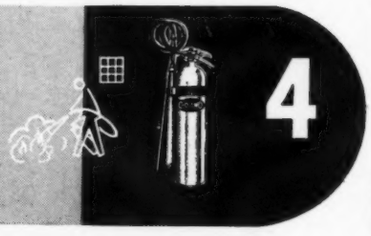
SIMILAR HAZARDS constantly vulnerable are adequately protected by C-O-TWO hose reel units ready for instant action with a fast uncoiling hose ready to blast fires with dry, sub-zero carbon dioxide gas, the fastest non-damaging, non-conducting, non-deteriorating fire extinguishing agent.



HURRY UP CALLS are covered by C-O-TWO wheeled units. Sturdily made of durable materials and easy to operate, fast and safe in single or double cylinder sizes equipped with adequate length of hose. Rolled easily and quickly by one man to scene of fire and take minimum space when not in use.



QUICK ON FIRE-KILL anywhere are C-O-TWO Squeez-Grip hand portable extinguishers. Always ready for use, no wheels to turn, no preliminary adjustments. Give instant action even while being carried by merely closing hand on the Squeez-Grip valve. Hand portables strategically placed can quickly kill many incipient fires.



C-O-TWO Kills Fire . . .
Saves Lives and Property

Write today
for modern fire protection information.

C-O-TWO

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 **NEW JERSEY**

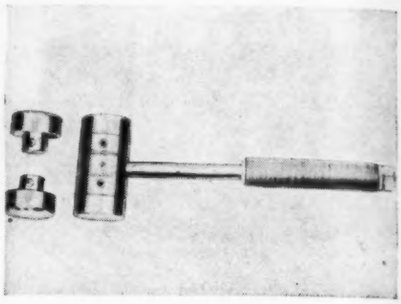
Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

used as handle for old blades which have been ground for use as knives or scrapers. Simplifies operations such as keyhole sawing. A. D. McBurney, 939 West 6 St., Los Angeles 14.

Soft Hammers

Two models of soft hammers in the light sledge weight range are announced. One has a replaceable copper or brass head, the other replaceable brass or copper tips. Each



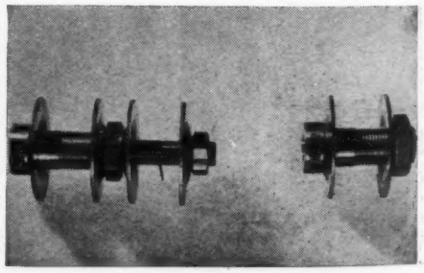
type has 1¾-, 2-, 2¼-, or 2½-in. diameter heads and weighs from 4½ to 10½ pounds. Equipped with safety leather washer handle. Steel head on the removable tips model is case hardened. Gregory Tool & Mfg. Co., 5300 Tireman, Detroit 4.

Automatic Liquid Cutoff

The V-202 automatic liquid cutoff valve is for mounting on the outlet line of a storage tank. Operates on balanced principle, and closes automatically to prevent the introduction of air into the line. Weighting of the preloading chamber can be varied for different tank levels and operating conditions, and additional weight can be put on top of the lower diaphragm, if desired. All parts are accessible for inspection, and the indicator, which shows whether the valve is open or closed, is hooded to keep out dirt and grit. Valves are built with iron bodies, aluminum valves, fitted with non-metallic seating rings, and steel stems. Although 2-, 3-, 4-, and 6-in. sizes are standard, others can be furnished. Oceco Div., The Johnston & Jennings Co., Cleveland 14.

Combination Arbor

The No. 150 Super Arbor, a combination attachment arbor for ½-in. electric motor shafts, is designed to take grinding wheels with ¾-in. holes on main shaft, or ½-in. holes on the small ends. The extension can be used for rag or wire wheels, or for circular



Why Speed Nuts are *First* with all Five

NOTHING LOCKS LIKE A SPEED NUT

TWO distinct forces are exerted on the screw, as a SPEED NUT is tightened.
First, a compensating thread lock, as the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs compensate for screw thread tolerance variations.
Second, a self-energizing spring lock, created by the compression of the arch in both the prongs and base. The combined forces of the thread lock and spring lock definitely prevent vibration loosening.

FIRST WITH ENGINEERING **because SPEED NUTS simplify design and are, or can be produced to meet any assembly requirements.**

FIRST WITH MANAGEMENT **because SPEED NUTS are time-tested, vibration-proof fasteners that improve the quality, and prolong the life of the finished product.**

FIRST WITH PURCHASING **because SPEED NUTS lower inventory costs, reduce stocking problems, and are DELIVERED on time. Production and service facilities are unlimited.**

FIRST WITH PRODUCTION **because SPEED NUTS eliminate extra handling of parts, are applied faster and easier, and compensate for a wider range of tolerances.**

FIRST WITH TIME STUDY AND COST **because SPEED NUTS slash total net assembly costs to a fraction of other assembly methods.**
Investigation will show that SPEED NUTS should be YOUR first choice, too. Write today.

TINNERMAN PRODUCTS, INC. 2096 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In France: Aerocessoires Simmonds, S. A., Paris
In England: Simmonds Aerocessories, Ltd., London
In Australia: Simmonds Aerocessories, Pty. Ltd., Melbourne

Speed Nuts* PATENTED

*Trade Mark Reg. U. S. Pat. Off.

FASTEST THING IN FASTENINGS...OVER 3000 SHAPES AND SIZES

THE END OF INFLATION

You can blow up a balloon just so far—and then it busts. As pressure approaches the danger point, the only way to save it is to let some air out.

Inflation is like that. We have some of it now, and we're headed for more.

There must be a limit.

Raise wages too high, without increasing production, and goods are bound to cost more. Raise prices too much and still higher wages will come. One always follows the other.

For there are only two ends to inflation—collapse or bust. Both of them hurt.

All of us need to remember that a dollar contains only one hundred cents—and that there's no sense in trying to redivide a dollar until after it is earned.

And dollars are earned only by producing more, and selling more, at a profit.

Sound policy for any business is made up of high wages for high production, plus good controls, to insure the low prices which mean large sales volume.

Geo. D. Trundle Jr.
President

This organization of over a hundred trained engineers has twenty-seven years of consulting management engineering experience. We invite you to write for more information on any of the above subjects, or to request a personal interview in your office.

THE TRUNDLE ENGINEERING COMPANY

Cleveland, Ohio, Bulkley Building

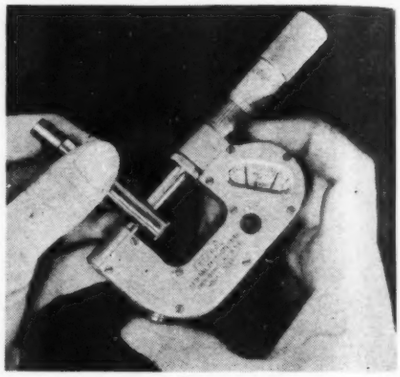
CHICAGO, City National Bank Building, 208 S. LaSalle Street

NEW YORK, Graybar Building 420 Lexington Avenue

saw blades. Also holds ½-in., 24-thread drill chucks, which in turn grip drills from No. 60 to those ½ inch in diameter. The arbor fits well over and onto main motor shaft, eliminating the possibility of "whipping" and disintegration of grinding wheel, according to the manufacturer. The Super No. 95 has been developed for mounting grinding wheels directly over motor shafts. A. D. McBurney, 939 West 6 St., Los Angeles.

Micrometer

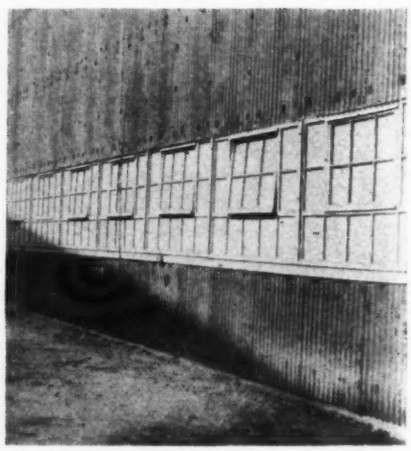
Type 200P-1 micrometer is said to combine the accuracy and the precision of dial indicator. Also can be used as a dial indicator comparator without setting to a master, because micrometer feature furnishes precision setting. Anvil pressure is constant and therefore, maker states, the accuracy of the instrument can be realized, independent of "feel." Indicating dial is integral with frame, and is provided with tolerance



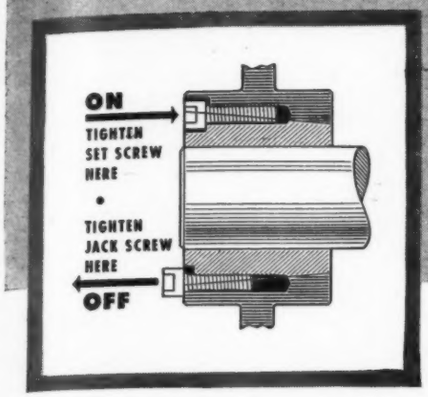
hands, which can be set with wrench furnished with gage. Micrometer scale and indicating dial are graduated in 0.0001 inch, and the measuring capacity is 0-1 inch. Both contact faces are tungsten carbide tipped, and are lapped parallel. The retracting mechanism operates separately from the movement and does not influence the reading. Federal Products Corp., 1144 Eddy St., Providence, R. I.

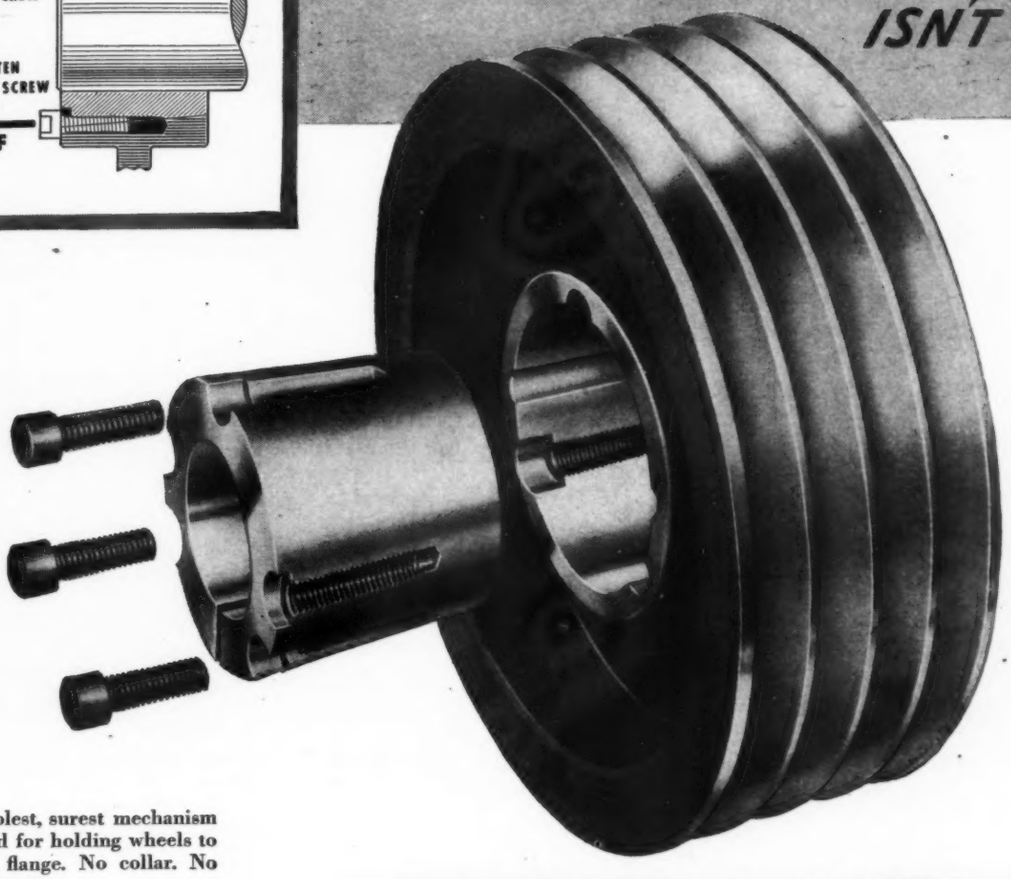
Protected Metal

Plastipitch-treated metal, for roofing and siding on industrial buildings, consists of flat, corrugated, or V-crimp steel sheets, the



Simple, ISN'T IT?





New TAPER-LOCK *Sheave*

PATENT APPLIED FOR

- The simplest, surest mechanism ever devised for holding wheels to shafts! No flange. No collar. No protruding parts.
- The Taperlock Sheave mounts as a complete unit. Slip it on, line it up and tighten *while sighting.* It's in place on the first try!
- The bushing is wedged into the sheave by means of set screws—with a firmness equivalent to a shrunk-on fit—whether the shaft is standard or normally undersize.
- The Taperlock runs *true.* The bushing extends the entire length of the hub; it provides a *full* bearing surface.
- Close mountings are made possible. No flange nor collar nor other device is required at either end of the sheave hub.
- The Taperlock "unlocks" with less effort than any other sheave—due to its special taper.
- Taperlock Sheaves will be stocked by Dodge Transmissioneers in principal cities—and will be available in ALL stock sizes.

Easy on—easy off—locks fast to the shaft! ALL the advantages you've ever dreamed about in a sheave are *here*—in the simplest, quickest acting mechanism ever developed for the purpose!

For full details call your local Dodge Transmissioneer. You'll find his name listed under "Power Transmission Equipment" in your classified telephone directory. Or write

DODGE MANUFACTURING CORPORATION, MISHAWAKA, INDIANA

DODGE
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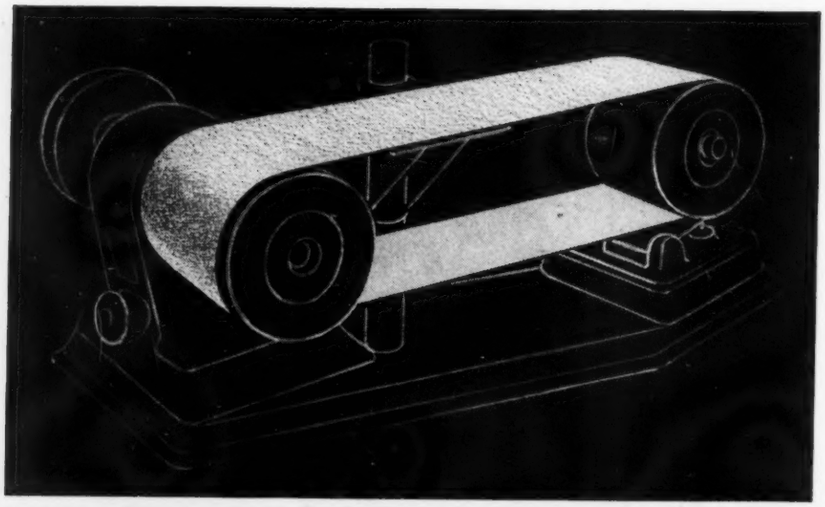
SIGN OF THE DODGE TRANSMISSIONEER
There are 257 Dodge factory graduate Transmissioneers, located in principal cities, to show you NEW and BETTER ways of transmitting power. See your local classified telephone directory.

FIRE-EATER!

At a grinding temperature of 1700° F. — almost the temperature of flame . . . SILVER STREAK Metal-Working Cloth Belts turn out the work with ease. The special Silver Streak bond stands up at extremely high temperatures and insulates the cloth backing from the intense surface heat. Available in grits 50 and finer.

FREE SAMPLES gladly furnished to industrial users. Pick a tough job, give us specifications, and make a test at speeds that cut your finishing costs.



Abrasive Products, Inc.

SOUTH BRAINTREE 85, MASSACHUSETTS

JEWELOX • JEWEL EMERY • JEWEL GARNET • JEWELITE • JEWEL FLINT • NEW PROCESS

surfaces and edges of which have been treated with the compound. It is claimed to provide permanent adherence to metal at low as well as high atmospheric temperatures, and to protect the base from rusting, corrosion, salt air, and the effects of chemical fumes. After coating, the sheets are provided with additional surfaces to give added protection. Besides roofing and siding, the material is suitable for gutters, ventilators, flashing, ducts, and similar applications. The sheets can be fabricated without special equipment, can be bent without impairing the coating, and do not require further painting. Koppers Co., Inc., Tar & Chemical Div., Pittsburgh.

Oil Transfer Truck and Sump Cleaner

Dispensing oil, as well as removing dirty oil, dirt, chips, sludge, and scale from sumps or tanks of machine tools is accomplished by oil transfer truck and sump cleaner. Fitted

for removable barrel—either standard open-end or closed-end drum. A second sump cleaner is a mobile self-contained unit consisting of tank, motor-driven pump, long suction hose, and large roller bearing wheels. Has capacity of 80 or 125 gallons. Honan-Crane Corp., 702 Wabash Ave., Lebanon, Ind.

Change in Name

Rockwell Manufacturing Company is the new name of the Pittsburgh Equitable Meter Company, Pittsburgh. The divisions and subsidiaries of the company manufacture meters, regulators, and instruments for the measurement and control of liquids and gases, lubricated plug valves, cast and forged steel valves, wood and metal working machine tools, punch presses and allied equipment, iron castings, and machine parts.

Pneumatic Filter-Lubricator

Filter-Lube is a compact pneumatic filtering unit combined with a precision lubricator to service air cylinders, vises, chucks, or any reciprocating or rotary air tools. Automatic in operation, it is designed to prolong the life of all types of pneumatic equipment, prevent freezing of air-operated devices, and

MODERNIZE

YOUR PRODUCTION WITH *Salem* FURNACES

One of two giant Salem Rotary Furnaces at Globe Steel Tubes Co., Milwaukee, Wisconsin. Designed, engineered, built, and installed by Salem Engineering Company, builders of all sizes and types of heating furnaces and allied equipment.

NEW SALEM HEATING INNOVATIONS WILL HELP CUT YOUR COSTS

Here are two examples of how modernized heating can improve production costs.

Salem can tie in all of your heating operations with other production sequences . . . Result—*savings in handling costs alone* will amortize the original cost.

Complete mechanization of heat treating plus elimination of messy operations up production and improves your product quality. . . . These are two of the many ways Salem Engineering Company helps pare costs by modernizing heating furnaces and equipment. Let Salem's engineers apply their peace and wartime experience to your operations.

CALL SALEM . . . originators of Engineered Heat and Builders of the World's Largest Rotary Hearth Forge Furnace.

"Engineered Heat"

SALEM FURNACES

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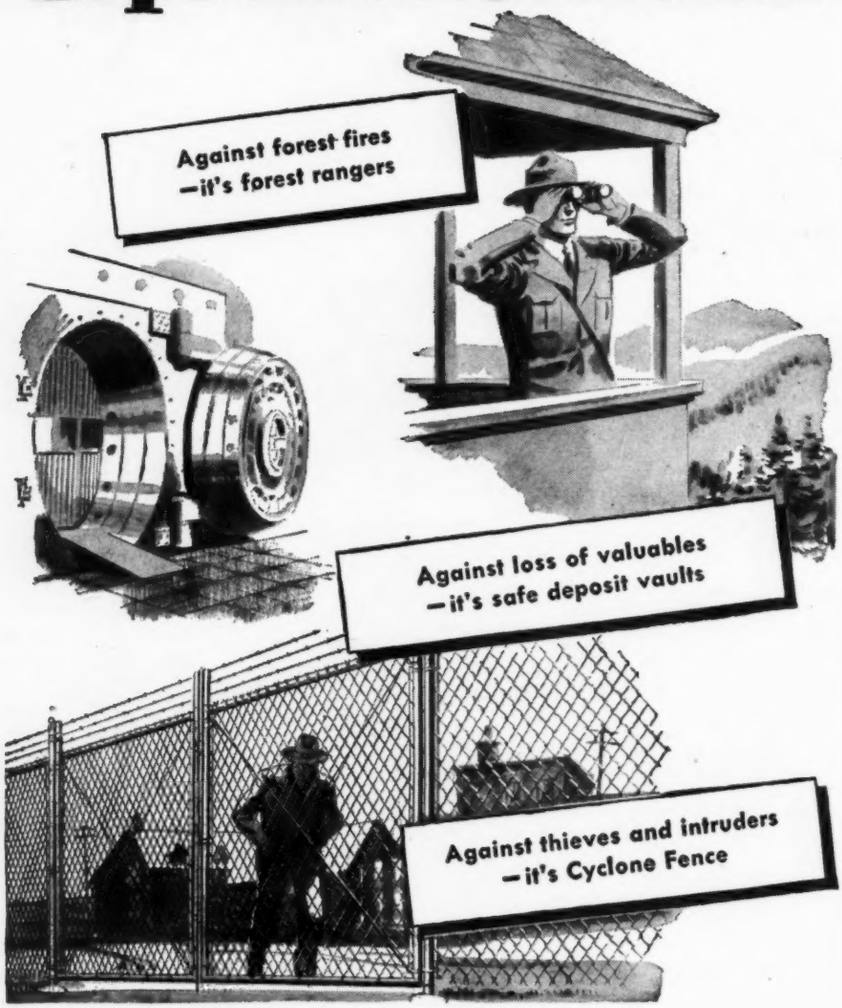
SALEM

Tops in Protection



CYCLONE Fence protects more plants than any other fence in the world. It can protect your property too, with year after year of satisfactory service.

Investigate Cyclone Chain Link Fence for yourself. Note the expert design and sturdy construction which keeps the entire fence always taut and true, despite difficult terrain or weather conditions. And let our experienced engineers assist you — without obligation — in planning your requirements.

We can now take care of orders promptly. But whether you need fencing now or not, it will pay you to have Cyclone's illustrated 32-page book, "Your Fence". It gives you useful, specific reference data on many types of U·S·S Cyclone Fence, Gates, Wire Mesh Partitions and other property safeguards. And it's free. Why not have your secretary send the coupon today?

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We'll send you our free, 32-page book on fence. It's full of facts, specifications, illustrations. Shows 14 types of fence. Before you choose any fence for your property, get the facts about Cyclone.

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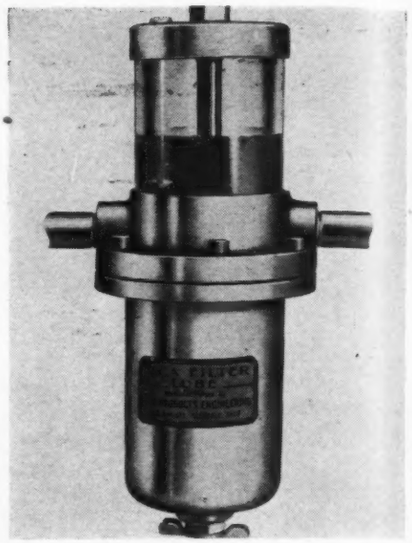
Interested in Fencing: ☐ Industrial; ☐ School; ☐ Playground; ☐ Residence. Approximately.....feet.

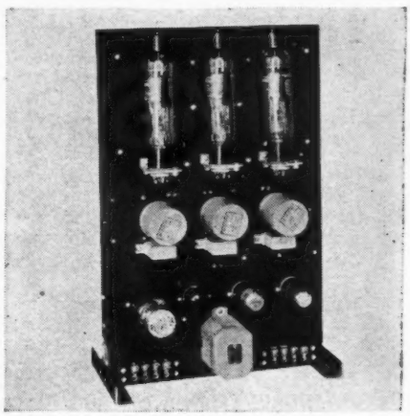
UNITED STATES STEEL



to deter corrosion. Available in ¼-, ⅜-, and ½-in. standard pipeline sizes. Features a full-view, lightweight transparent plastic lubricator oil reservoir, showing the quantity of oil in the element, with adjustable needle valve oil regulator. Lower element of unit is composed of a sludge basin and an all-wool felt filter media. CCA Products Engineering, P. O. Box 671, Glendale, Calif.

Variable Speed Drive

Speed is controlled electronically in variable speed drive, named Servotron. Operates on a.c., and through electronic controller runs a d.c. variable speed motor. Maintains uni-



form torque over entire speed range. Eliminating changing of gears, the drive has instantaneous dynamic braking and reversal without speed overrun. Submarine Signal Co., 160 State St., Boston 9.

Pressure Switch

Electrical control switch, actuated by changes in fluid pressure, provides a means for regulating or indicating fluid pressures, or for controlling circuits operated by pressure changes of a liquid or gas. Electrical control element is a standard single-pole, double-throw switch. Type M switch is rated at 15 amperes, 125 volts a.c. to 2 amperes, 600 volts a.c., or ½-horsepower at voltages up to 460 a.c. For low voltage d.c. applications,

COLORFUL

ANNOUNCING! NEW SALES APPEAL

FOR YOUR PRODUCT!

SHERWIN-WILLIAMS

DIMENSO

Trade Mark Reg. U. S. Pat. Off.

Revolutionary New Three Dimension—Two Color Finishes with a Single Spray Operation!

Give your product a startlingly beautiful finish with hammered metallic or diffused multi-color effects . . . in one spray operation! A finish of highest quality in hundreds of color combinations to make your product stand out and SELL.

New in effect, DIMENSO is practical in use . . . can be applied with standard spray equipment and the patented DIMENSO gun. Background color and dimensional color are sprayed simultaneously through one nozzle producing a smooth, uniform finish.

DIMENSO is a synthetic finish of highest quality—fits every baking schedule—bakes to a crack-free finish that resists wear, cleans easily. It's economical . . . two colors applied in one operation, only one baking.

Exclusive Registered Dimenso Finishes

Sherwin-Williams will work with you to develop your DIMENSO combination. That combination will be registered and be yours alone. Call for a demonstration today.

FREE!

DIMENSO BOOKLET...

A request on your business letterhead will bring this interesting booklet describing DIMENSO and containing actual finish samples.

Write The Sherwin-Williams Co.
Cleveland 1, Ohio

SHERWIN-WILLIAMS INDUSTRIAL FINISHES

Five Good Reasons for AMERICAN PRESSED-STEEL HAND TRUCKS Leadership

1. Pressed-Steel Construction makes American Hand Trucks practically indestructible.

2. Accurate Balance makes heavy loads easier to handle—lightens the load on the trucker.

3. Accurately Machined Wheels and Axles make American Hand Trucks easy rolling.

4. Bolted Assembly makes maintenance fast, easy and inexpensive.

5. Rubber Tread Wheels roll easily and reduce noise, wear on floors and damage to loads.

Write for Catalog T-45 today! Get full information on the 39 types and 60 sizes of American Pressed-Steel Hand Trucks.

BE SURE YOUR TRUCKS ARE AMERICAN... THE RED HAND TRUCKS

The American Pulley Company • 4212 Wissahickon Ave., Philadelphia 29, Pa.

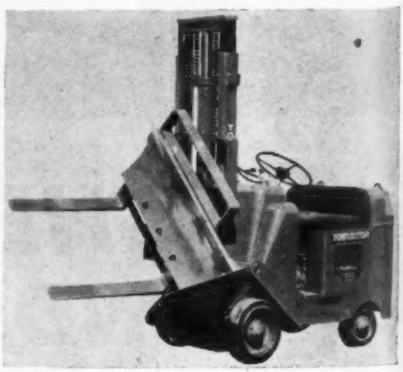
standard Type A switch has a maximum current rating of 25 amperes at 28 volts d.c. Unit can be furnished for operation with a differential of 5 to 15 pounds at nominal ratings of from 10 to 120 p.s.i. Pressure chamber is made of a corrosion- and heat-resisting material, and maker claims that the unit can be safely operated at temperatures up to 300 deg. F., and can withstand severe vibration. Mu-Switch Corp., Inc., 380 Pequit St., Canton, Mass.

Thermocouple Tubes

Cast-iron thermocouple protecting tubes have a uniform wall thickness to within plus or minus $\frac{1}{32}$ inch. They are cast with both ends open, permitting positive support for the core at each end. One end is closed with a cast-iron plug, welded in place with a cast-iron filler rod, the opposite end threaded for a 1-in. standard pipe. Inside diameter is $\frac{11}{16}$ inch; outside diameter, $1\frac{1}{8}$ inch; wall and minimum top thickness, $\frac{3}{16}$ inch; weight, 4.5 pounds. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Wayne & Roberts Ave., Philadelphia.

Lift Truck Accessory

Known as the Upender, lift truck accessory is designed to turn or "up-end" rolls of paper from vertical to horizontal position, or vice versa. Said to provide speedy, safe carrying and stacking of rolls with a mini-



CIRCLE Ⓑ from billet to bolt...and that means uniform, controlled quality

From billet to finished product the manufacture of all circle Ⓑ fasteners is controlled in one plant—the largest independent in the country. For this reason you can depend on the hundred thousandth bolt or nut leaving the machine to be as accurate in size shape and thread as the first.

THE UNIFORM QUALITY OF ALL CIRCLE Ⓑ PRODUCTS BEGINS IN OUR OWN ROLLING MILLS.

Ⓑ BUFFALO BOLT COMPANY

NORTH TONAWANDA, NEW YORK

ALLEN TRU-GROUND

DOWEL PINS

support accurate tool and die work

They serve as locating pins for the diemaker's work — and then go on to general duty as pins and pivots in various machine assemblies. By their accuracy and strength they *retain* precision standards in tool and die assemblies under punishing stresses.

They are ground to a limit of .0002" over basic size, with an allowable tolerance of plus or minus .0001". Surfaces are finely polished; subsequently treated with a rust-preventive.

Metallurgically in a class with ALLEN Hex-socket Screws: — made of the same special-analysis *ALLENOY* steel, heat-treated to an extremely hard surface, with a core of the right toughness to prevent "mushrooming" when driven into a tight hole... Tensile strength, 240,000 to 250,000 lbs. per sq. inch... Typically the Allen high safety-factor in HOLDING-POWER.

Ask your local ALLEN Distributor for samples and dimensional data... the same Distributor who serves you dependably with Allen Hex-socket Screws and other first-call mill supply lines.

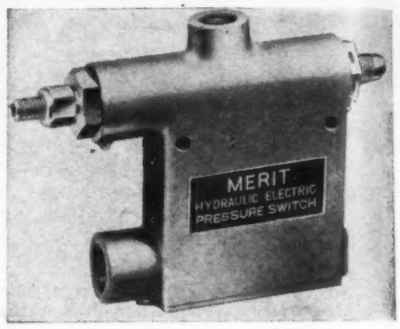
TRADE A MARK

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, . . CONNECTICUT, U. S. A.

mum of effort. Constructed of steel bar and angles, it has a regular elevating carriage mounted on the mast, and a revolving, or up-ending carriage. Tapered blade of steel, combined with a curved plate bolted to the Upender carriage, is the standard attachment for picking up rolls of paper on end. A pair of forks is used for picking up, carrying, and stacking horizontal rolls, and acts as a backrest to stabilize rolls in vertical position. A full apron with steel blade can be furnished in place of the standard combination of curved plate, blade, and forks. Towmotor Corp., 1226 East 152nd St., Cleveland 10.

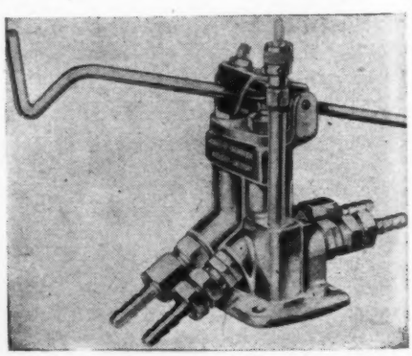
Hydraulic Electric Switch

Precision-engineered hydraulic electric switch features chatterless hydraulic valve which is a self-contained cartridge, renewable and interchangeable. With two cartridges, having different springs, it covers operating range of 100 to 3200 p.s.i. Externally operated screw allows close adjustment without breaking the line. Closely adjusted opening and closing throughout pressure range is provided by balanced design, supplemented by the two springs. With the first, pressures of 100 to 400 p.s.i. are obtainable; with the second, pressures of 400 to 3200 p.s.i. A differential of 15 to 18 percent actuates switch. Has contacts of special alloys for hard service. It is a single-pole, single-throw, normally closed design. The d.c. rating is 40-amp. 28-volt inductive load; 17-amp. 125-volt, and 8½-amp. 250-volt non-inductive load. Merit Engineering, Inc., 40 Clifford, Providence, R. I.



Welding Torch Holder

Model E. Gasaver, said to cut oxygen and acetylene consumption as much as 50 percent, features non-smoking pilot light. Lever rod, on which torch is hung between welds to shut off both gas and



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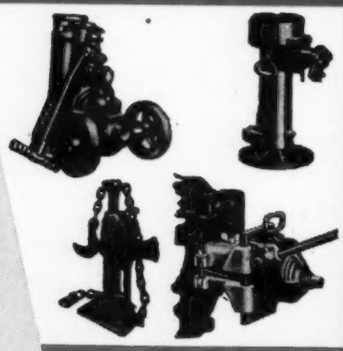

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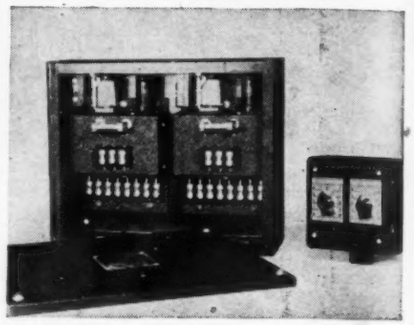
oxygen intake lines, is adjustable in length, enabling torch of any size or weight to operate closing valves automatically. Unit eliminates the danger of open flame. Listed as standard by Underwriters Laboratories. Weldit, Inc., 652 Bagley Ave., Detroit 26.

Electronic Timer

Type 2T15U electronic repeat cycle timer is for machinery and process control in applications requiring two adjustable timing periods to run in a continuous cycle. Cycle is initiated by either momentary or sustained contacts, and provision is made for automatic recycling. Control is accomplished



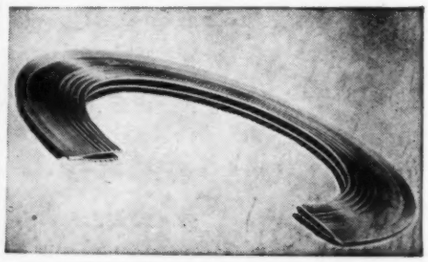
through snap-action relays. Interval variations in repeat cycle timing are less than 2 percent. Timer is universal for six maximum time ranges from 1.5 seconds to 2 minutes for each period of the cycle. Instrument is set by dials which are located either on the timer itself or in a small housing at a more convenient location. Operates on 115 volts a.c. or d.c. Photoswitch, Inc., 77 Broadway, Cambridge 42, Mass.

Protective Apron

Light duty industrial apron is designated for protection against oil, acid, caustic, and water. It is double-coated by calendar method with Ameripol synthetic rubber. Made in two sizes, 29x35 inches, and 34x45 inches, it is constructed with hemmed edges and attached neck and waist tapes. Suitable for use on light assembly and bench work. Apron is impervious also to gasoline and benzole, and is abrasion-resistant, maker says. The B. F. Goodrich Co., Akron, Ohio.

Pressure-Sealed Gasket

Serrated type gasket, known as Bellowseal, uses the pressure to be sealed to exert a corresponding sealing pressure on the flange



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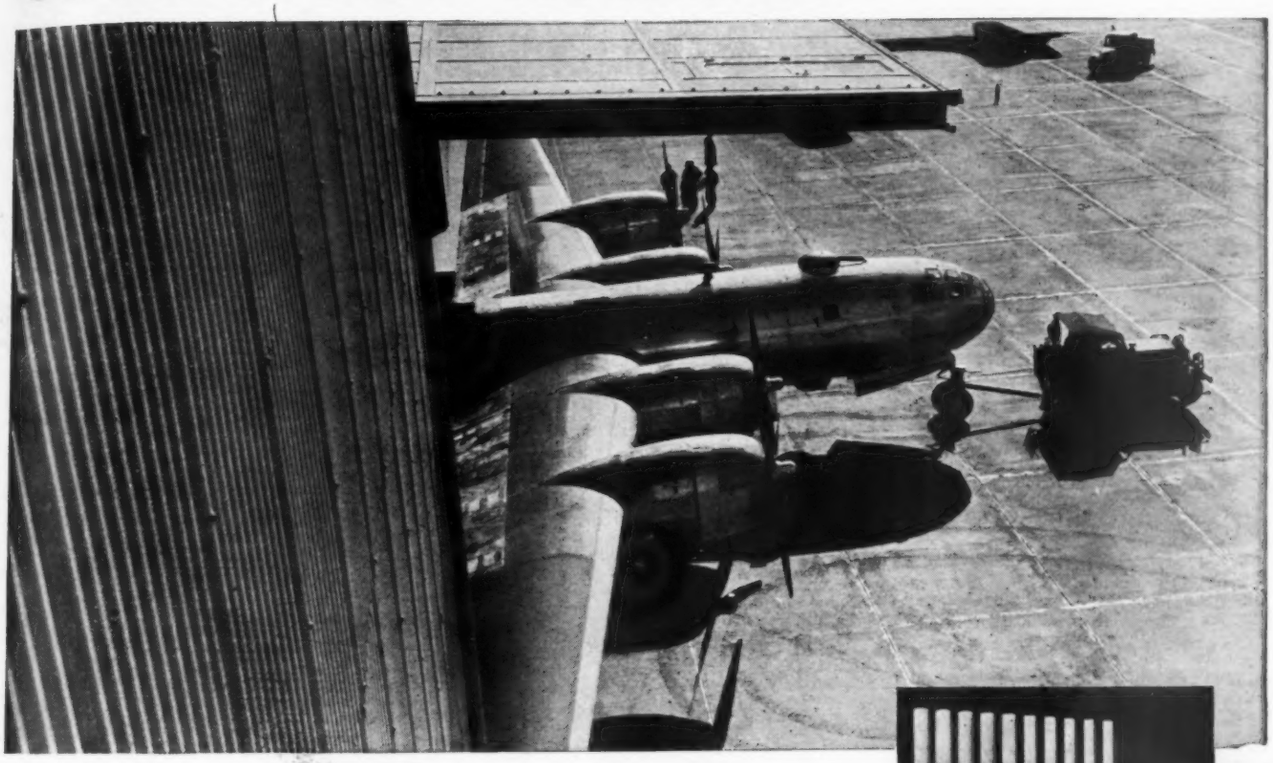

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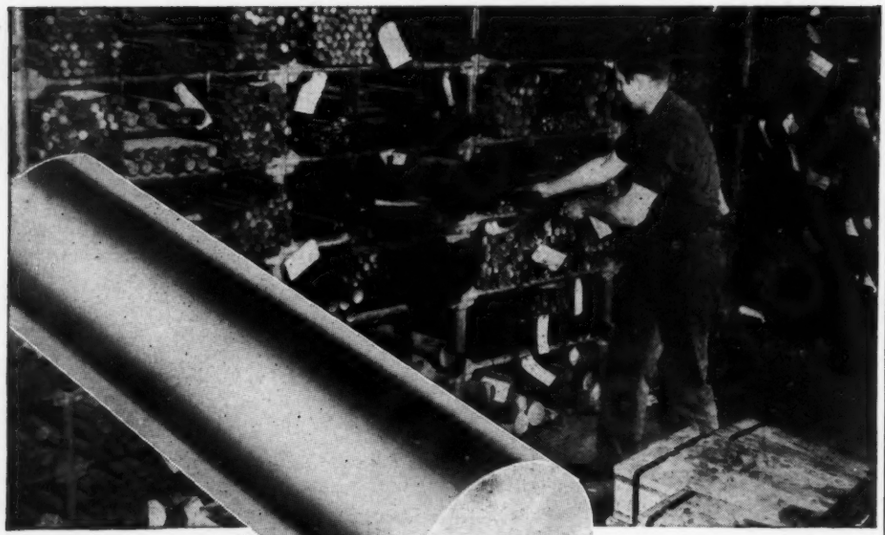

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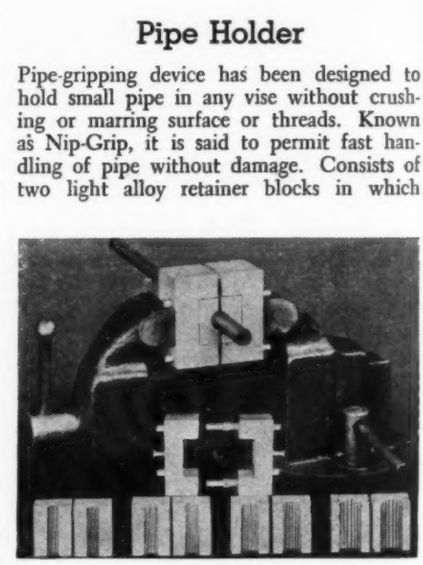
faces. Consists of two disks of metal (Armco iron, low carbon steel, monel, or stainless steel), machined on external faces with standard serrations, and welded together around outer periphery. It combines pressure- and corrosion-resistant properties with the light bolting requirements of a softer sealing medium. Line pressure entering the interior of the gasket exerts expansion pressure in excess of the required sealing force. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Compressed Air Valve

Adaptable to any job for which blow valves are required, compressed air valve is designed for positive control of air flow. Flexibility of the unit, angle of nozzle, and flexing control lever permit directing compressed air stream to the spot where needed. Rubber valve washer, operated by control lever, prevents leakage when not in use. Valve is of simple construction, having no packing or springs. Washer is the only part which may need replacement. Flex-Rite Valve & Mfg. Co., 118 South Cheyenne, Tulsa 3.

Pipe Holder

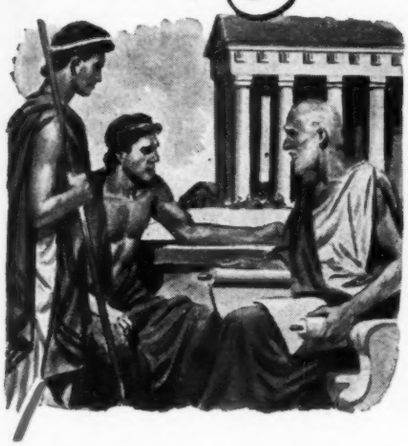
Pipe-gripping device has been designed to hold small pipe in any vise without crushing or marring surface or threads. Known as Nip-Grip, it is said to permit fast handling of pipe without damage. Consists of two light alloy retainer blocks in which



hardened steel inserts are slipped to hold pipe of different sizes. Inserts of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ inch are furnished. Springs automatically spread the blocks apart when vise is opened. Holder can be positioned horizontally or vertically, and is held by pins. J. A. Campbell Co., 645 East Wardlow Rd., Long Beach 7, Calif.

Air Reducing Valve

Internal pilot operated air reducing valve, known as Class L-1A, is said to provide steady, accurate regulation and tight closing in dead-end service. Features stability under all flow conditions, responsive instant reaction to wide and sudden variations in load, and has plastic inserts in valve seats for positive tight shutoff and long life, maker states. All wearing parts are renewable, and



When an ancient Greek philosopher once predicted that "Human slavery will continue until the loom weaves of itself," he really called the turn of important events to come. Events destined to free men from slavery . . . cut the costs of goods . . . raise the standard of living—

In early colonial days in our country, our forefathers were still spinning and weaving by hand, as the early Greeks did, to make clothing for the family. The driving force that was to mark another important milestone in man's progress, was still to be discovered—

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complete interchangeability facilitates overhauling without removal from pipeline. Stainless steel main valve, bronze controlling valve, and corrosion-resistant piston rings are used to obtain corrosion and wear resistance. A similar valve, known as Class JA-1, designed for control of small air valves, is similar in construction, except that a neoprene diaphragm is used in place of bronze piston. Leslie Co., 112 Delafield Ave., Lyndhurst, N. J.

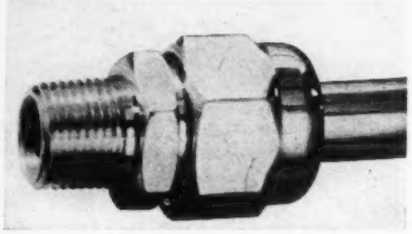
Pipe Flange Opener

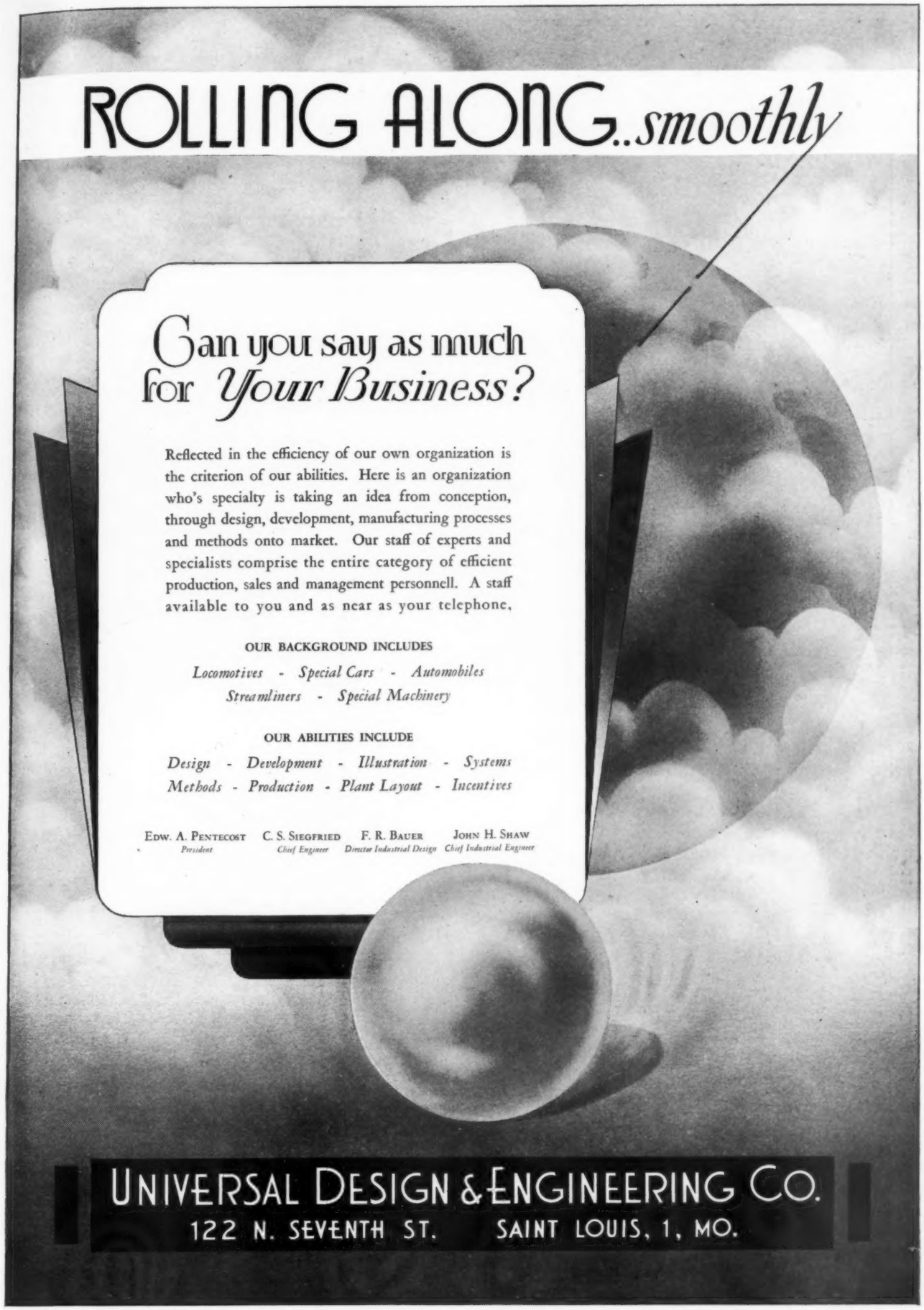
Tool that is said to open pipe flanges for gasket renewal quickly, easily, and safely, is announced. Eliminates need for hammer and chisel. With Flange-Jacks, it is claimed that pipe flanges may be opened or closed without damage to flange faces, and without danger from sparks, eliminating the hazard in working on flammable lines or in presence

of gas fumes, as well as possible injury to personnel from chips and flying wedges. The tool exerts pressure smoothly, eliminating vibration along the pipeline, and the possibility of causing new leaks in nearby joints. Capable of opening joints against a load of 15 tons without damage to the flanges. Simple in design; jaws are heavy one-piece steel forgings; screw points are case hardened. Standard size opens all 2- to 20-in. flanges. T. G. Persson Co., 224 Glenwood Ave., Bloomfield, N. J.

Tube Fitting

Flexigrip tube fitting eliminates end preparation or soldering of the tubing, and produces a strong leakproof flexible joint, manufacturer states. Made in standard sizes from ⅛ to 1¼ inches OD, it consists of four parts—body, gripping ring, synthetic rubber gasket, and nut. To attach fitting, the nut (with gasket

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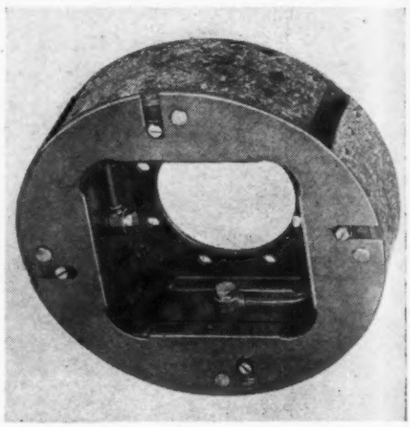
and ring inside) is slipped over any plain-end tube, cut to desired length. Tubing end is inserted into the body as far as it will go, and nut is tightened. Tightening nut compresses ring into tight grip and molds gasket around ring for a leak-proof seal that is flexible to withstand vibration or impulse. Available in brass, aluminum, or steel. Gustin-Bacon Mfg. Co., Kansas City Mo.

Industrial Brake

Operating on ordinary factory airline pressures, industrial brake is claimed to exert as much braking effort as conventional brakes using ten times this pressure. About 90 percent of the drum is lined, and braking pressure is evenly distributed. Mechanism may be used either to stop or retard industrial equipment, or to provide a constant tension or braking effort. The four multi-stage diaphragms that actuate the shoes are interconnected, for equalized pressure on brake circumference. Shoe movement is



radial only, and brakes may be operated in either direction. Drum can be supplied with separate annular air circulating housing to provide additional cooling where brake applications are frequent and heavy, or when a constant heavy drag is being provided by the brake. Linderman Devices, Inc., Newburgh, N. Y.

Drafting Pencil

Draftsman's refillable pencil No. 3583 has clutch which holds the lead firmly in a non-slip rubber grip. This is claimed to prevent the nicking and scoring of lead, which cause breakage. Long barrel permits the use of

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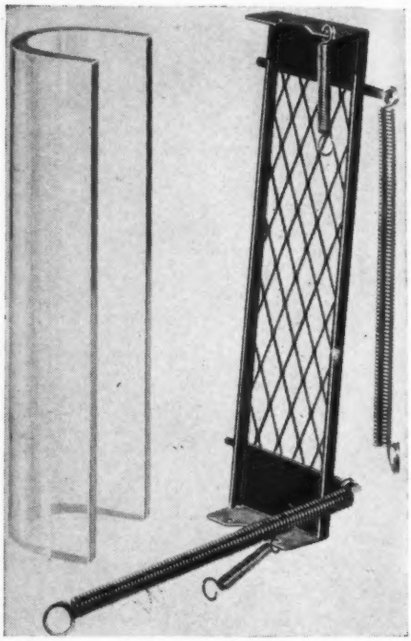
Gage Glass Protector

Gage glass protector, named Kleervu, consists of two parts—the metal frame, with four holding springs, and a ¼-in. thick transparent "Nuglas" cover. If gage glass bursts or explodes, all flying broken glass is safely confined in the shatter-proof enclosure. While protection is said to be absolute, there is no loss of visibility, no blind spots, or



corners. The cover encircles gage on three sides, and visibility is clear from all directions. In the back is a screened frame which holds the cover and provides an open vent area for escaping steam in case of gage glass breakage. Protectors are available in any length required for tubular gage glasses on boilers, process tanks, chemical tanks, oil tanks, cookers, and other installations. Wright-Austin Co., 301 West Woodbridge St., Detroit 26.

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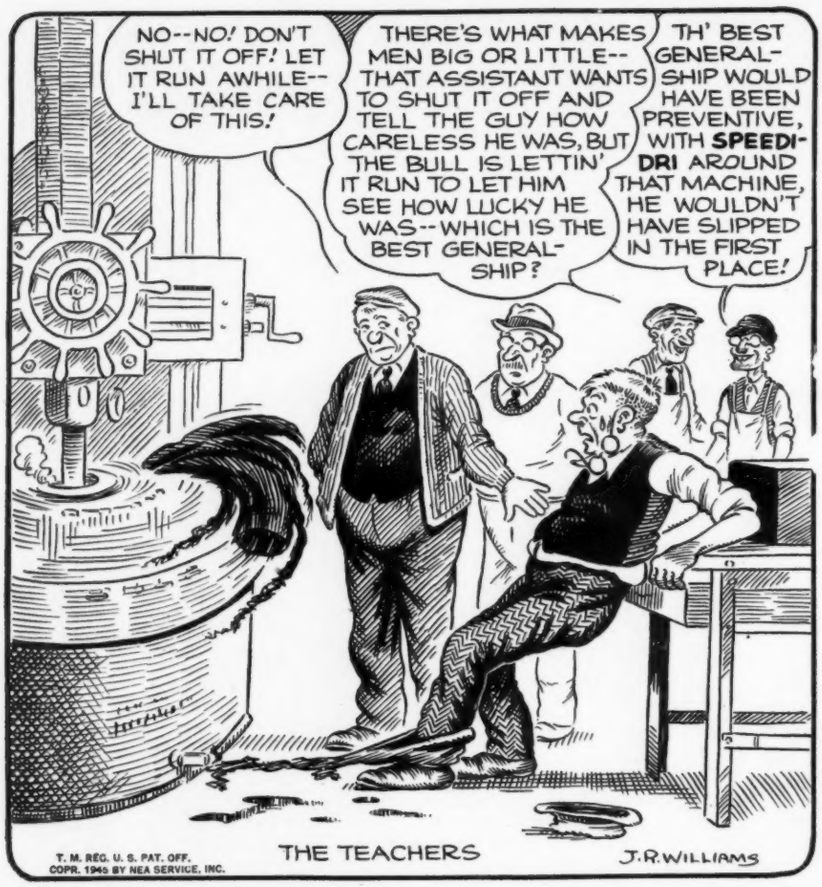
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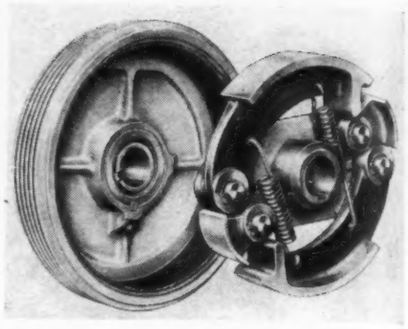
Easy to use. Just spread a thin carpet of SPEEDI-DRI, and it immediately provides a white, clean, non-skid surface to walk on and work on. Sweep it up with a stiff broom. It leaves floors clean, dry and *safe*.

SPEEDI-DRI works well on all types of floors. It requires no complicated, expensive machines; little labor; no dangerous caustics, solvents, or other compounds.

Write today for big, free sample and practical demonstration in your plant. Just tear out this page and attach your business card. SPEEDI-DRI for oils and grease . . . SOL-SPEEDI-DRI (the all-purpose product) for soluble oils, solvents, syrups, resin, and coolants, as well as regular oils and greases.

***SUPPLIERS: East*—Safety & Maintenance Co., Inc., New York 1, N. Y.**
***South, Midwest & West Coast*—Waverly Petroleum Products Co., Philadelphia 6, Pa.**

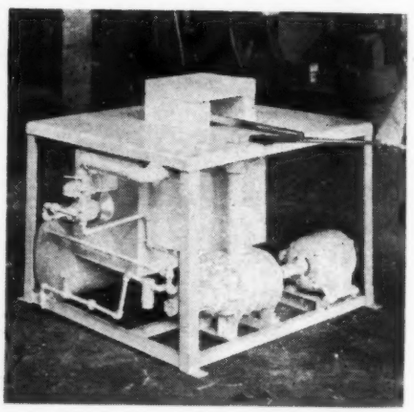
SPEEDI-DRI
OIL AND GREASE ABSORBENT



shoe type, dual-spring balanced, to give the degree of tension required for individual applications. Two models are available—one for range from fractional to 3 horsepower, and one for up to 6 horsepower. Different drives can be mounted on shaft. Salsbury Motors, Inc., 4464 District Blvd., Los Angeles 11.

Forge

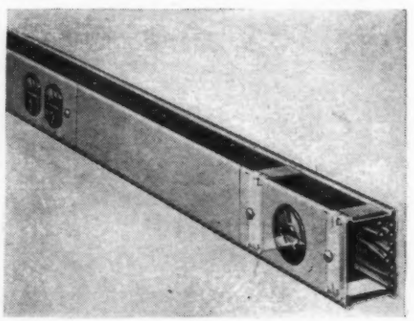
Metal heating forge has a fuel (oil) supply tank, pump, motor, blower, burner, and combustion chamber combined in the unit. Plugs into any a.c. 220- or 440-volt circuit. Heat is concentrated at the table



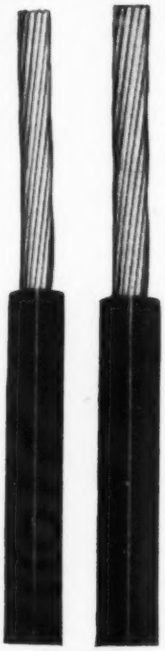
work opening, and bar stock, angles, as well as pieces can be heated on end, center, or where needed. Use of light fuel oil is said to eliminate smoke and soot. Mahr Mfg. Co., Div. of Diamond Iron Works, Inc., Dept. A., Minneapolis 11.

Surface Raceway System

Embodying the lay-in principle, Surfaceduct No. 1700, a $1\frac{3}{8}$x$2\frac{1}{8}$-in. two-piece surface raceway of base and capping, and a minimum



FLAMENOL* TYPES T AND TW WIRE FOR COMPLETE WIRING SYSTEMS



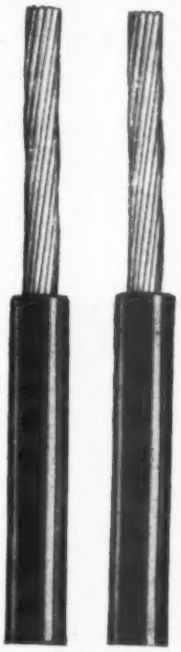
Type TW
for wiring in
wet locations

FEATURES

1 Small Diameter—Saves space, makes wiring easier
2 Superaging!—Long life, no oxidation
3 Easy Pulling—Hard, smooth, glossy surface
4 Heat Resistant—Rated 60 deg C
5 Free Stripping—Speeds up splicing and soldering
6 High Dielectric Strength—720 volts per mil, test result on wire
7 Flameproof—Will not support combustion
8 Insulation—Tough, Tensile strength of 2000 lb per sq in., test result
9 Permanent Colors—Same color range as Type R wires
10 Oilproof—Resist deterioration by oils, water, acids, alkalies
11 Attractive—Retain their fine appearance
12 Self-protecting. Weather Resistant—No braids necessary

(In addition, Type TW insulation has low moisture absorption)

Here is a small diameter, high quality building wire available in sizes No. 14 to 2,000,000 CM. It is ideal for new wiring, rewiring and maintenance wiring. Its small diameter enables more copper to be placed in conduits. Also this wire is easy to pull in conduits and may be stripped quickly. The insulation of both Type T and TW has long life, is high in dielectric and mechanical strength and is resistant to oils, acids and alkalies. Type TW also has a low moisture absorption rate.



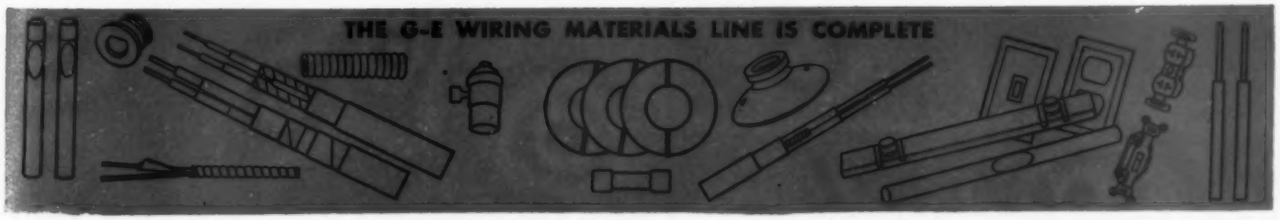
Type T
for general
purpose wiring

SPECIAL PURPOSE CONDUCTORS

Other G-E wires, cables and cords particularly suitable for industrial use include lead-sheathed wires and 2- and 3-conductor cables, Types RL or RHL; BX armored cable and Flamenol heavy-duty and medium-duty portable cords. These special purpose conductors are high quality and give long service.

FOR FURTHER INFORMATION on Flamenol Types T and TW building wire or lead-sheathed wire and cable or BX or Flamenol portable cord, see the nearest G-E Merchandise Distributor or write to Section W263-37, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

*Reg. U.S. Pat. Off.



GENERAL ELECTRIC

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

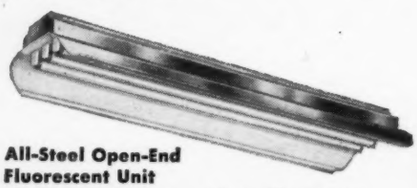
Skilled Lighting

Means Light that is RIGHT

The elimination of eye strain, glare, and shadows is just as important as a high level of illumination. Skilled Lighting, the Wheeler way, puts the right amount of light in the right places to achieve four benefits that have an important bearing on profits: greater manual speed, increased accuracy, less spoiled work, and improved worker morale. Skilled Lighting makes your plant a better place to work.

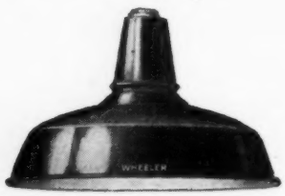
The broad line of Wheeler Reflectors is the backbone of Skilled Lighting. It offers the right fluorescent or incandescent reflector for every area or "spot" in your plant. All are built of heavy gauge metal for long, hard service.

Look in the Wheeler Catalogs for reflectors that show the results of Wheeler's advanced engineering based on 65 years of manufacturing experience. For copies, write to: **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channels with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.



RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

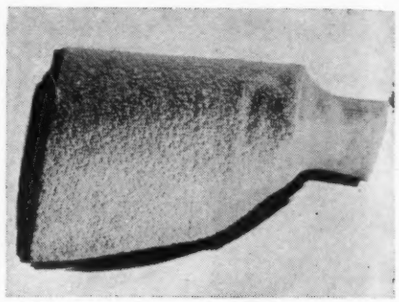
Wheeler Skilled Lighting **REFLECTORS**

Made by Specialists in Lighting Equipment Since 1881

number of fittings, provide a raceway system for electrical requirements up to 60-amp. loads. Designed to facilitate the use of flexible power tools and machines, as well as electrical applications required for light, heating devices, and power. Arch-type bridge in raceway allows maximum wire capacity, retains the wires during installation, locks the snap-on cover, and serves as a method of installing devices. Four of the bridges are included with each 10-ft. length. Combination T and offset service fitting make possible the installation of devices in an offset position from the raceway, and provide an unobstructed raceway for maximum wire fills. Electric Products Corp., Pittsburgh.

Protective Cuff

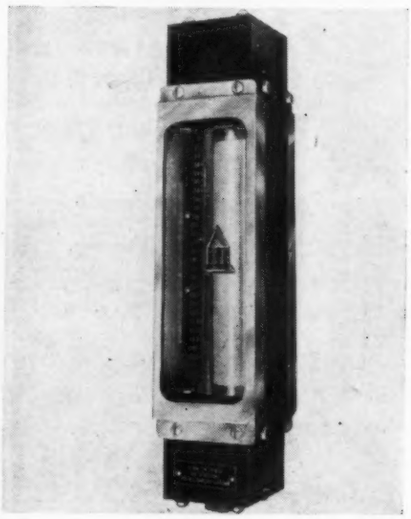
Jomac Gauntlet-Cuff, for protection of the forearm, can be worn with wrist-type safety gloves. Cuffs can be retained for use with

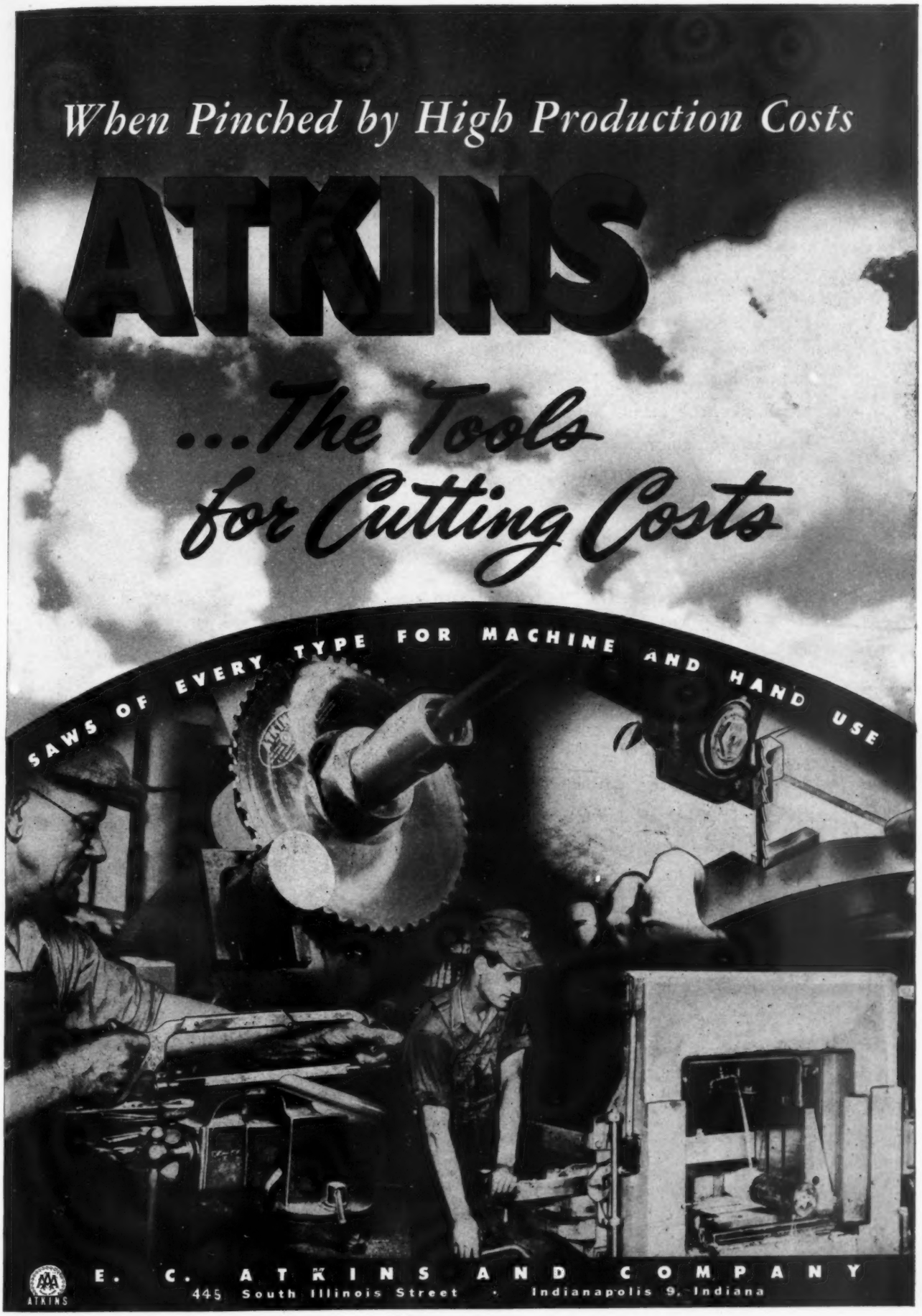


new gloves when worn gloves need to be replaced. Fit snugly at the wrist around safety gloves. C. Walker Jones Co., 6133 N. Lambert St., Philadelphia 38.

Rotameter

Full-view rotameter, with safety shielding, is for accurate flow rate measurement and control. Shielding is obtained by front and back safety glass windows with stainless steel frames. All surfaces are gasketed to prevent leakage. Equipped with an interchangeable precision metering tube, called Tru-Taper. Space between side plates is wide, allowing float position to be easily read, even from an angle. Meter parts are

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ATKINS
...The Tools for Cutting Costs
SAWS OF EVERY TYPE FOR MACHINE AND HAND USE
E. C. ATKINS AND COMPANY
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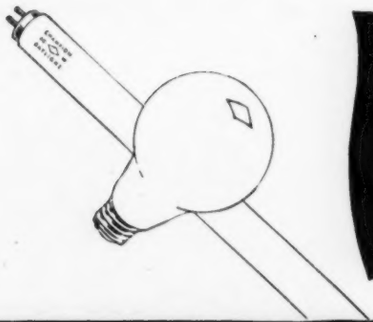
ATKINS

WHEN YOU BUY CHAMPION *Lamps* HERE'S HOW MUCH MORE YOU GET FOR YOUR MONEY

1 **Champion Quality**—the result of forty-six years of concentration on the manufacture of lamps for industrial service. Champion **Fluorescent** and ***Incandescent*** Lamps are guaranteed to *equal or exceed* Federal Specifications and backed by the production and quality control resources of one of the largest lamp producers in the industry.

2 **Champion Economy**—the entire Champion manufacturing and distributing set-up is devoted to the job of getting lamps to you at minimum cost. When you standardize on Champion Lamps you can be certain of getting the most lighting and lamps for your money.

3 **Champion Service**—trained lighting experts in the field to help you on every lighting problem, and a carefully selected industrial distributor near your plant, ready and able to provide prompt, intelligent and economical attention to your lamp needs on the spot.



Try Champion Lamps and find out for yourself how much these extra advantages mean to you. Let us give you the name of nearest Champion industrial distributor.

CHAMPION LAMP WORKS

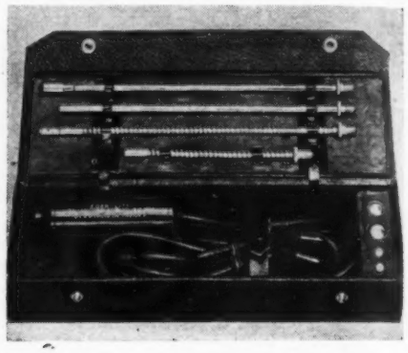
Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

treated to prevent external corrosion. With metal tapered tube, it can be used for pressures up to 600 p.s.i. Device can be obtained as a simple flow rate indicator, or with remote instrument for recording or recording-controlling flow rate. Flow totalization also can be included. Brooks Rotameter Co., P. O. Box B-1233, Lansdale, Pa.

Inspection Lamp

Miniature inspection lamp, called Eder-Lite, makes it possible to light up and visually inspect cylinders, gear housings, tubes, rifle barrels, pipes, and other equipment with small openings. Has small light-reflecting and glareless metal-protected tungsten bulbs attached to flexible or rigid extension. Power



is supplied through a rubber-insulated wire cable to a transformer enclosed in a bakelite handle. In fields where there is danger of explosion or fire, the lamp can be had in a special safety model. Standard set consists of a built-in pushbutton type transformer lamp handle constructed for a.c., a 10-ft. plug-in cord, and two rigid and two flexible extensions of different length that can be used in combination or separately. Harmon & Co., 6 N. Michigan Ave., Chicago 2.

Cranes

One man can lift, move, and lower up to 2000 pounds with Blue Heron cranes, maker says. Two models are available—portable and truck types. Portable unit is made in 1000- and 2000-lb. capacities, and narrow enough to pass through shop doors, aisles, and between machines. Has two height adjustments, enabling it to get into ordinarily inaccessible places, such as reaching in truck

A *SERVICE* AS RELIABLE AS THE PRODUCTS

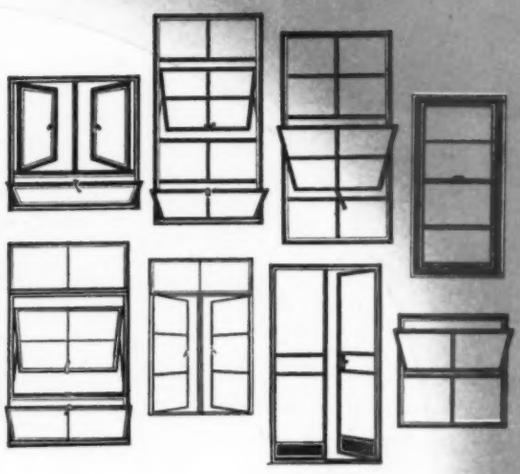
WAREHOUSE
STEEL PRODUCTS

BATES GRATES
OPEN STEEL FLOORING

APS PLASTEEL
ROOFING and SIDING

and now—

THORN
· STEEL · WINDOWS



DURING the war years just past, despite scarcity of materials, manpower shortages and restrictions, Levinson maintained its reputation for reliable warehouse service.

During these years, particularly in the tri-state area, they met the ever-increasing demands for such high-quality products as Plasteel Roofing and Bates Grates.

Levinson has been almost fanatically discriminating in their selection of the products they distribute. No less selective was the choice of THORN Steel Windows, now also being distributed by Levinson Steel Sales Co.

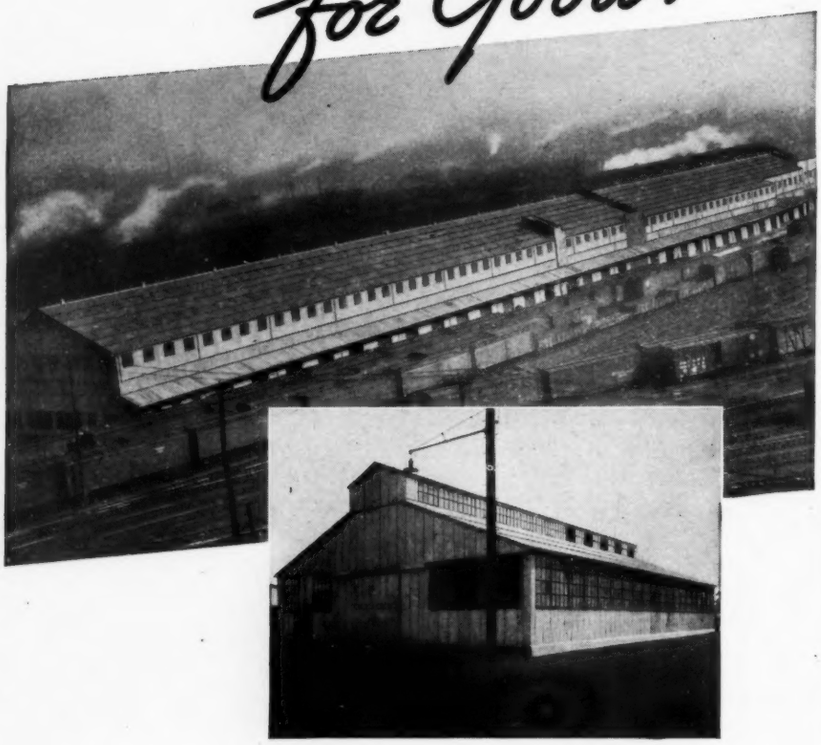
These products, proven by time and performance, are backed by a service as reliable as the products!

LEVINSON STEEL

LEVINSON STEEL SALES CO.
Pittsburgh 19, Pa.

PUT YOUR PLANT UNDER COVER...

for Good!



Large or small, the plant that is housed in Blaw-Knox Standard Steel Buildings, is under permanent protection.

Furthermore, the original cost is moderate, the time needed for design and erection is reduced to a minimum, and the cost of maintenance is practically nil.

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for your copy of Bulletin No. 1791—on your letterhead, please.

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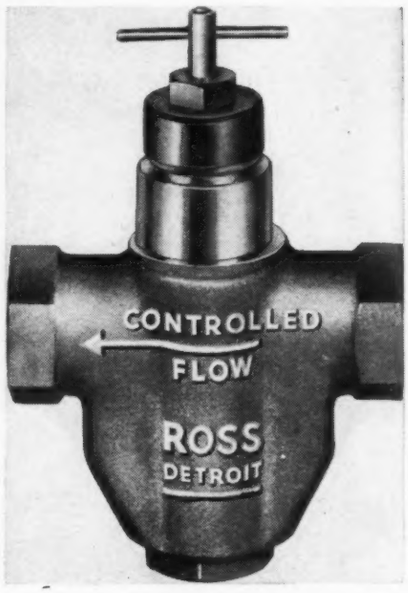
OF BLAW-KNOX COMPANY
2031 Farmers Bank Building, Pittsburgh 22, Pa.
NEW YORK • CHICAGO • PHILADELPHIA • BIRMINGHAM • WASHINGTON

BLAW-KNOX STEEL BUILDINGS

cab to remove transmission, or under shelf to pick up heavy parts. Special capacities and types can be supplied. The truck cranes come in 1000- and 2000-lb. capacities for truck installation. A 500-lb. capacity unit can be used for motorcycle side cars. Cam Tool Co., 3080 Broadway, Oakland, Calif.

Air Control Valve

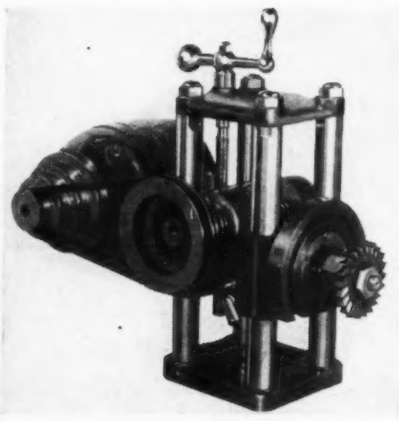
To provide full range of selectivity in the volume of air, thereby giving split-second control of the piston speed of the pneumatic equipment on which it is used, is the purpose of speed control valve. Flow of air from the cylinder to the operating valve is



regulated with precision, in either small or large volume, changes taking place with smooth progression. There are only two moving parts—stem and poppet—with the stem shaped to form a venturi for the passage of air in small volume. Ross Operating Valve Co., 6477 Epworth Blvd., Detroit 10.

Lathe Attachment

Portable attachment for engine lathes performs a range of metal working operations, such as milling, grinding, boring, and drilling, which formerly required various other



ANNOUNCING

THE NEW

Aerostand

"TWELVE"

An unusual, 12-foot, strong, dependable workstand now joins the famous Aerostand line. Simple hydraulic action puts platform at the exact spot for maintenance and repair work in factory and shop. Exceptional ground clearance. Choice of air wheels, casters or solid tires. Adaptable for use with all Aerostand accessories. Greater efficiency through mobile equipment is the modern key to operational savings.

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"SCIENTIFICALLY SIMPLE"

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FOR FOOL-PROOF SAFETY EVERY TIME
IN CUTTING MOTORS FROM THE LINE,
THIS FEDERAL RELAY DOES THE TRICK
WITH THOSE WHO KNOW—
IT'S BOUND TO CLICK!

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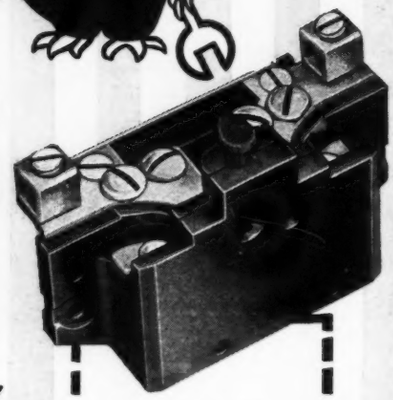
OVERLOAD RELAYS
STANDARD EQUIPMENT ON



Federal NOARK
MAGNETIC
MOTOR STARTERS

Wherever overload protection is needed . . . whether on new or existing installations . . . Federal's Overload Relays will provide the "plus-margin" of dependability generally associated with Federal products. Naturally, these relays are built into Federal Noark Magnetic Starters . . . but remember, too, that they're available for your special applications. Federal Overload Relays provide conveniently located load and control circuit terminals, often making additional terminal blocks unnecessary.

DESIGNED FOR AUTOMATIC OR MANUAL RESET

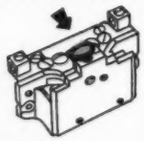
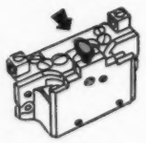


Diagram shown above illustrates Plunger (arrow) set for "automatic" reset.



Plunger is set for "hand" reset in above diagram.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. · PLANTS: HARTFORD, CONN. · NEWARK, N. J.

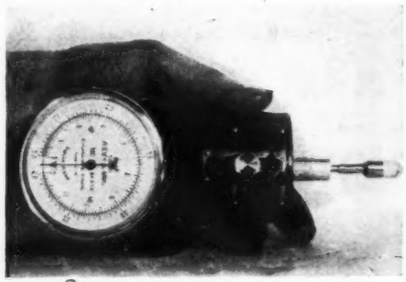
standard machine tools. Basic unit of converter, known as Lathe Converter, will mill, cut keyways, and do angular drilling. Extra interchangeable heads enable converter to perform external and internal grinding, and to do angular milling. Broach attachment permits internal keyseating, and geared dividing head for precision indexing proxides for gear and spline cutting and grinding. Converter is a self-contained motor-driven unit, mounted in the tool post position on engine lathe. Also can be used as a vertical head on other machine tools. Master Manufacturing Co., Hutchinson, Kan.

Aluminum Coating

Corrosion-resisting properties of coal tar and the appearance of aluminum are combined in a one-coat job with coating now on the market. The aluminum pigment used is grade A (varnish grade) aluminum powder mixed into coal-tar base, and the powder floats to surface after application, giving aluminum finish. Coating can be either brushed on or sprayed. It does not flow during or after drying, or crack, check, or peel on exposure to temperatures as low as minus 30 deg. F., or flow at temperatures as high as 160 deg. F., the maker says. Designed for use on metal surfaces which are exposed to corrosive agencies, coating may also be used on cement, tile, wood, and brick surfaces. Furnished in 1- and 5-gal. cans, and 55-gal. drums. Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis 4.

Hand Tachometers

To enable engineers to read the revolutions per minute of any revolving equipment, precision hand tachometers, which operate on the centrifugal principle, are presented. Have five speed ranges, and knurled ring provides speedy shifting. Made in four models —Model A, from 30 to 12,000, B from 45 to 18,000, C from 60 to 24,000, and D from 120 to 48,000 r.p.m. Each dial is individually calibrated for each instrument. Revolving shafts can be measured as close as 1 revolution per minute. In the Model A, the hand reads to 1 r.p.m. and fractions of one revolution may be estimated. Attachments also are provided to give feet per minute. George Scherr Co., Inc., 200 Lafayette St., New York 12.



Dielectric Heating Unit

Portable Model 88XO Red Head Thermex high frequency dielectric heating unit has an output of 5 kw. delivered at approxi-

On this completely rebuilt heavy duty shaper at the Krautter-Weber Tool Works, the use of Veelos V-belt provided the following engineering advantages: 1. Eliminated overhead motor and overhead belt drive. 2. Provided better speed control...old drives had only one speed forward and return. 3. Ended noise and excessive vibration.

WHEN the Krautter-Weber Tool Works, Newark, N. J., decided to modernize this heavy duty shaper—built many years ago—it specified Veelos link V-belt on four vital drives. Efficient speed control was a "must"—and, in selecting Veelos, Krautter-Weber chose the belt that helps hold machine speeds at desired rates *by providing uniform belt tension and by eliminating belt slippage:*

1. Veelos Provides Uniform Belt Tension: Veelos patented link construction permits easy adjustment so that each strand of a multiple V-drive carries its exact share of the load. All strands constantly work together, delivering full power.

2. Veelos Ends Slippage: Quick, easy adjustment of Veelos ends belt slippage... keeps machinery running at full speed and assures full productivity.

To modernize old equipment... to assure maximum service on new equipment... to replace V-belts on any equipment... specify Veelos. A Veelos engineer will gladly assist you—just write and arrange an interview.

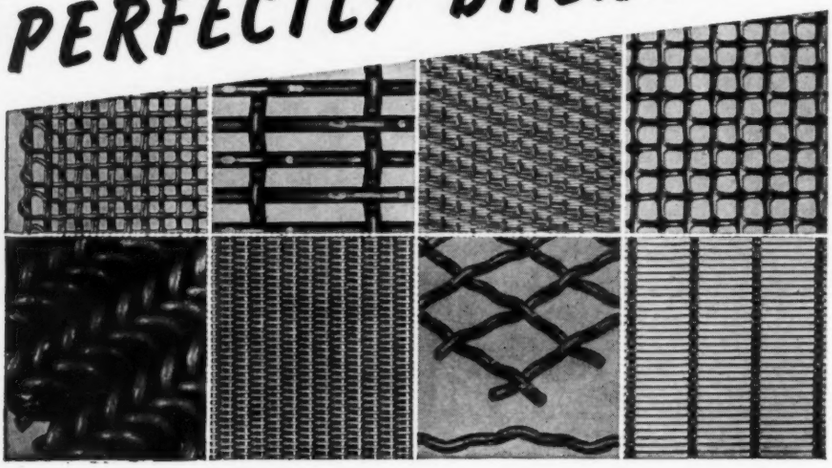
VEELOS
THE LINK
V-BELT
Adjustable to any Length
Adaptable to any Drive

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

LINK CONSTRUCTION UPS PRODUCTION

WIRE CLOTH COST AND SEPARATING SPEED

PERFECTLY BALANCED



To increase separating speed and lengthen your screen life, select a *higher quality alloy.*

Such alloys are woven by "Buffalo Wire." They permit you to go to a mesh of lighter gauge, and thereby achieve the perfect balance of productivity and screen life. The relatively higher cost of a durable alloy is more than offset by greater separating speed and less frequent wire cloth replacements.

NEW FOLDER 596

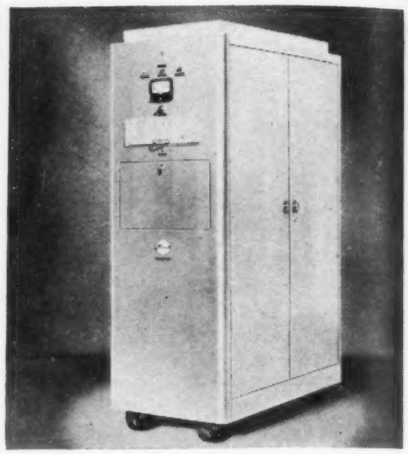
Tells how "Buffalo" Stainless Steel Wire Cloth cuts costs and improves performance in thousands of installations. Valuable data on corrosion-resistance. Write for your copy.

MANUFACTURER OF ALL KINDS OF WIRE CLOTH SINCE 1869

Buffalo WIRE WORKS CO., INC.

ESTABLISHED 1869 AS SCHEELER'S SONS

440 TERRACE **BUFFALO 2, N. Y.**



mately 20 megacycles, and raises the temperature of 4 pounds of average purpose material 170 deg. F. in 1 minute. Claimed to preheat preforms rapidly and uniformly, shortening molding cycles as much as 300 percent, to improve product quality, reduce the number of rejects, minimize insert and pin breakage, and to prolong the life of both the press and the mold. Equipped with standard automatic dual time controls, which permit the handling of two jobs by the same unit, regardless of variations of the preform sizes or materials. Requires no manual tuning during the heating cycle. Controls are behind locked door in the front panel. Thermex Div., The Girdler Corp., Louisville, Ky.

Weld-Spatter-Resistant Compounds

Two weld-spatter-resistant compounds, No. 9951 and No. 9952, furnished in powder form, ready to be mixed with water, are identical in performance. The difference between them is that No. 9951 is non-adherent and can be removed with air hose or dry cloth, while No. 9952 is semi-adherent, but can be removed with a damp cloth or direct stream of water. Work surface, even if slightly oily, does not require wetting before compounds are applied. The inert compounds cannot burn, and are smokeless. Mixture can be applied with ordinary bristle brush. One gallon covers 450 to 750 square feet of work, depending on the thickness with which compound is applied. Electric Welding Div., General Electric Co., Schenectady, N. Y.

Hydraulic Cylinders

Maximum power without leakage, and long-lasting accuracy of bore dimensions are claimed to result from the centrifugal-cast barrels and other features of the Rotocast hydraulic cylinders. Has "O" ring seals and automotive type piston rings. No tie rods or gaskets are used. Built for operating pressures to 1500 p.s.i. Cylinders are adapted for operations involving pushing, clamping, lifting, and other power movements in any direction. Maker says they permit improved product efficiency with low operating costs when incorporated in hydraulic equipment. Made in seven mounting types, three piston

AEROMATIC AIRCRAFT

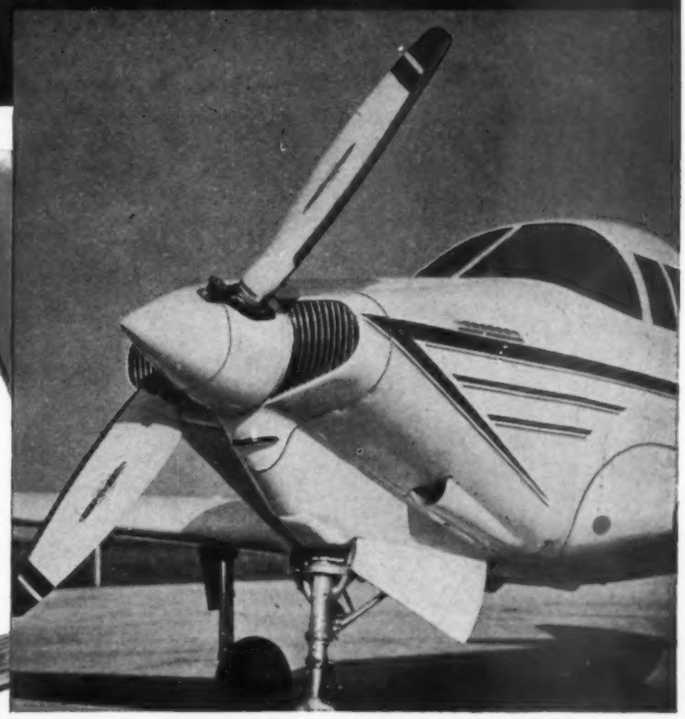
PROPELLER DESIGN REVOLUTIONIZED WITH WALDES TRUARC RETAINING RINGS

MEMO

KOPPERS CO., INC.
Aeromatic Aircraft Propellers

RE: WALDES TRUARC RETAINING RINGS

- ✓ Maximum thrust load of 30,000 lbs.
- ✓ Save at least 10% in weight
- ✓ Heavy nuts are discarded
- ✓ Hub threading, drilling and machining reduced to ring groove alone.
- ✓ Makes hub assembly self-locking
- ✓ Time savings of 75% in assembly and disassembly

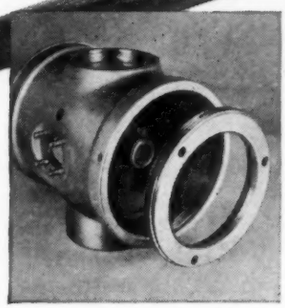


AEROMATIC AIRCRAFT PROPELLERS are standard equipment on the Rocket 185, illustrated above.

1

BEFORE TRUARC—

High centrifugal loads generated by whirling blades of automatic variable pitch propellers were borne by a buttress-threaded nut screwed into the hub. This meant expensive machining, extra weight.

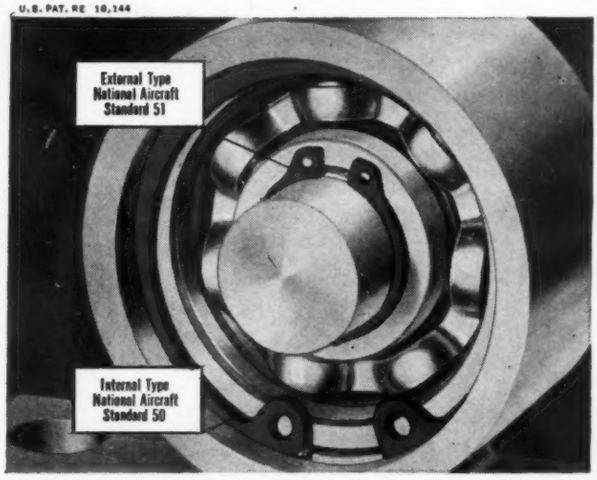


2

AFTER TRUARC—

Elimination of conventional nut greatly reduced weight —cut machining time and cost 75% — made over all maintenance easier. Truarc retention strength against tons of centrifugal force is 3 times greater than operating load.

U.S. PAT. RE 16,144



Waldes Truarc Retaining Rings are used to save weight, space, cost and time in a wide range of products. For holding and positioning machine parts they offer definite advantages over nuts, shoulders, collars and pins. They simplify and speed up production. They can be put on and taken off again and again—and still retain the perfect circularity which gives them their never-failing grip. Test them yourself. We'll furnish samples and complete data. Write Dept. I-2.

WALDES TRUARC TRADE MARK **RETAINING RINGS**

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

CANADIAN REPRESENTATIVES: FRENCO PROGRESS CORP., LTD., 72-74 STAFFORD ST., TORONTO

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"PLANT-WIDE TRANSPORTATION"

CAN LOWER YOUR COSTS...

• **FOR FORTY-FIVE** years Alvey-Ferguson has designed and *engineered* — for many of the world's leading plants—conveyor systems that provide an "endless stream" of production and help to keep all departments operating at highest efficiency.

A completely coordinated conveyor system, engineered by Alvey-Ferguson, in *your* plant will effect new economies! Saves time, eliminates unnecessary handling, reduces employee fatigue, greatly increases production and lowers your operating cost!

Why not investigate the possibilities of these savings? Let Alvey-Ferguson engineers, backed by forty-five years' experience, offer suggestions how to handle your materials and products more efficiently and economically. Write, without obligation, today.

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AFFILIATED CORPORATION:

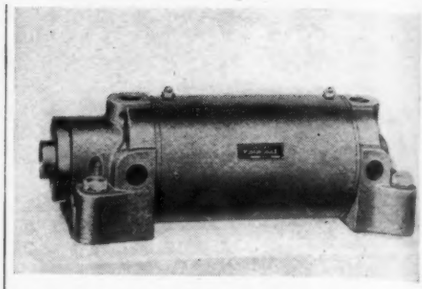
The Alvey-Ferguson Co. of California, P. O. Box 396, Vernon Branch, Los Angeles 11, California.

CONVEYING EQUIPMENT

A-F CONVEYING MACHINERY

Alvey-Ferguson

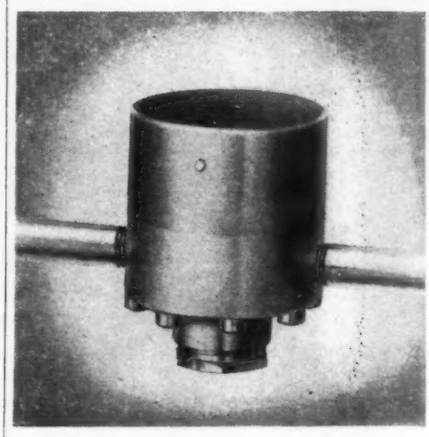
METAL PRODUCTS CLEANING & FINISHING EQUIPMENT



rod models, and nine standard bores, they are available with cushioning at one or both ends. Designed for oil, the cylinders may be used for water service if water is treated; if untreated, units of special material can be supplied. Logansport Machine Co., Inc., Logansport, Ind.

Pressure Reducing Regulator

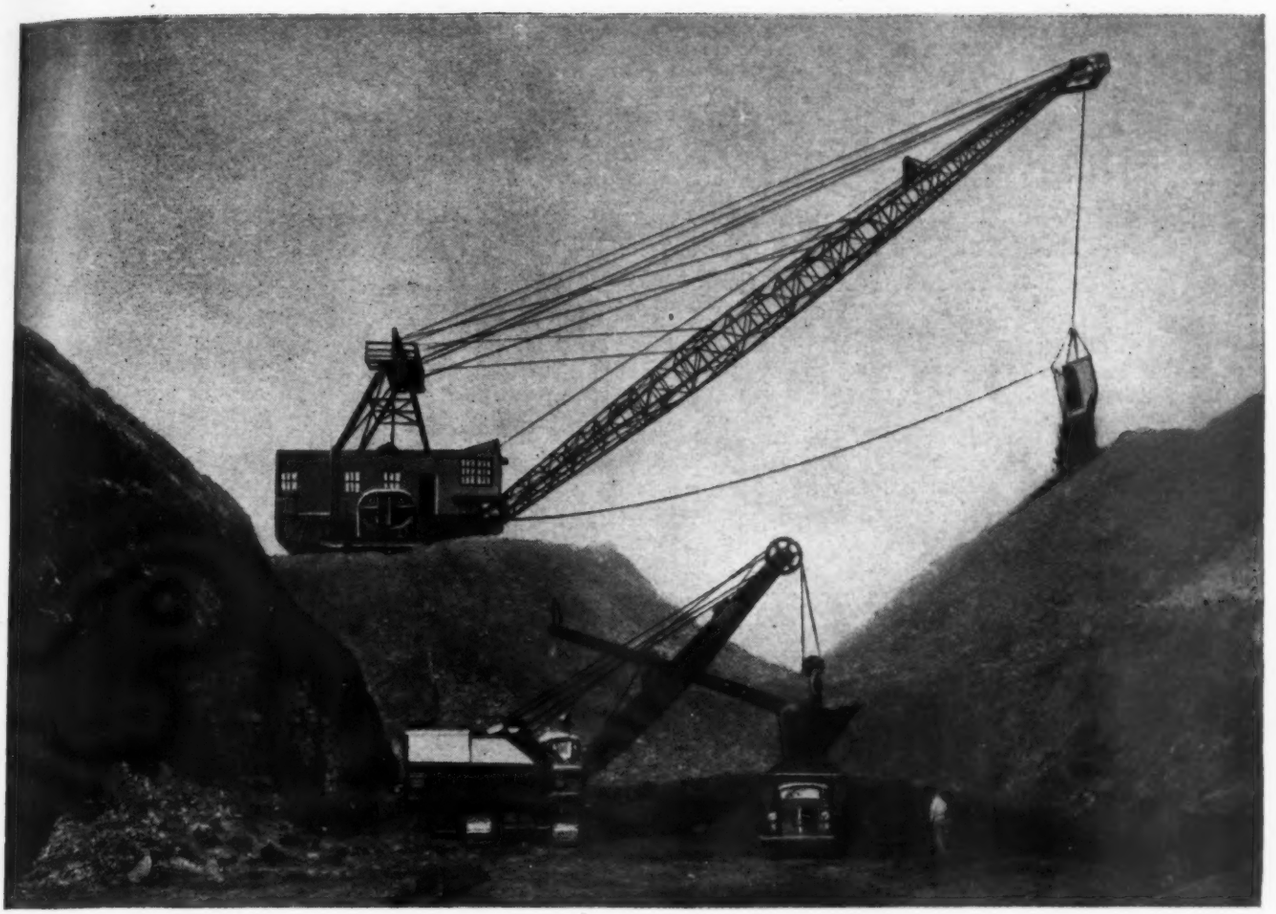
Small, compact Mity-Mite regulator, weighing less than 2 pounds, and measuring approximately 2¾x3¼ inches, is suitable for handling initial pressures up to 3500 pounds, with adjustable control range from 5 to 1500 pounds. Models can be supplied for higher initial pressures ranging up to a maximum of 5000 pounds. Capacity range



is said to be equal to that of regulators ten times its size. Although primarily designed for air and gases, including hydrogen, nitrogen, and oxygen, unit also can be furnished for liquid service. Has stainless steel ports and homogenous structure of duraluminum. Valve and seat construction is engineered for positive dead-end shutoff, and regulator is instantaneous in operation. Available for ⅛- and ¼-in. pipe sizes. Grove Regulator Co., 6593 65th St., Oakland 8, Calif.

Combination Guard and Counter

Operating principle of Counting-Guard is based on the sweep action of an adjustable guard arm which works with the downward motion of the ram. Even if the link breaks, guard still operates. While press is not in operation, the guard remains out of the way. As soon as clutch is tripped, guard sweeps completely beyond the press feed area on half of the downward stroke, brushing aside operator's hands before the dies close. Unit incorporates automatic counter, which registers each stamping. It is mounted on



One Of Wire Rope's Toughest Jobs!

THIS huge earth mover, known as a walking dragline, operating in a coal strip-mine, scoops up 6 tons of earth at every swing, each 50 to 60 seconds, day in and day out. Its efficiency---in fact, its ability to perform continuously month after month, year upon year---depends largely on a few strands of wire rope. ***This is one of the toughest jobs which wire rope is called upon to perform.***

Through these cables is transmitted all the power of a 400 horsepower Diesel engine, to swing a 160 foot steel boom and a truck size drag bucket. The wire from which this cable is made must be tough and strong---must resist abrasion---must be uniform in gauge and possess flexibility and other positive characteristics. These are the salient reasons why these cables are made from Youngstown's Yolectro High Carbon Rope Wire.

Like all its wire mill products, the wire supplied by Youngstown to wire rope manufacturers is of finest quality steel, refined, rolled and drawn to exact specifications. Youngstown wire can be furnished now to your specifications. Write, wire or phone our nearest branch.

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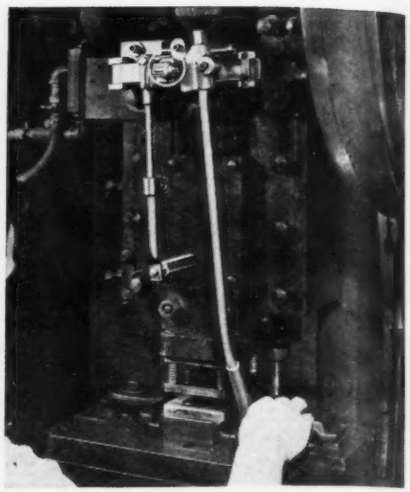
AIR COMPRESSORS

● Modern industrial engines are designed at much higher speeds than was formerly possible . . . and Schramm has kept its Air Compressors in pace with good modern design. So, today, even though your engines are speeded up, you can get all the compressed air you want with Schramm Compressors!

All Schramm Air Compressors have forced feed lubrication to all main bearings, main crankshaft, crank pins, piston pins and camshaft. There is a complete built-in, push-button electric starter system, and both the engine and compressor are 100% watercooled!

These are only a few Schramm features. Industry is today using Schramm Air Compressors for jobs wherever air is needed. If you are not using Schramm on your job, write today for construction details on these compact, sturdy units.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA



front part of assembly attached to cross bar, keeping operator aware of piecework rate. Does not operate unless the guard is in place. Device can be swung aside while making adjustments on press. W. H. Searjeant Co., 89 Allen St., Rochester, N. Y.

Drink Canteen

Automatic soda fountain service is provided by portable drink canteen. Supplies three kinds of beverages, chilled to any predetermined temperature, in individual paper cups. Serviced by manufacturer, one filling serves 250 drinks, and paper cups are stored

in protected containers until delivered to purchaser. All supplies are stored in unit itself, as well as a built-in cup disposal compartment. Canteen can be connected to any electric circuit. It is 30x23 inches, and 6 feet high. New York Automatic Canteen Corp., 314 East 23rd St., New York.

Cleaning Unit

Portable, oil-fired, enclosed coil-type steam generator delivers hot vaporized cleaning solutions under selective pressures up to 200 pounds, for removal of grease, grit, grime, paint, and other deposits from surfaces. No. 1, No. 2, or No. 3 fuel oil, kerosene, or gasoline may be used to operate the unit. Power for driving mechanical parts is pro-

THE PICTURE OF COMFORT...

is easily worth 10,000 words on increasing workers' efficiency. The comfort of posture seating—the proper chair for worker and job—helps employees do better work faster.

Harter builds steel posture chairs for all jobs—in factory, shop, and office. Every model features three adjustments: height of seat, height of back, and distance of back from the work being done. By permitting the worker to sit erect—comfortably balanced and firmly supported—these adjustments eliminate fatigue caused by poor posture and cramped muscles.

The engineering skill and quality materials which go into Harter Posture Chairs mean years of trouble-free service. Employers like their efficiency—workers like their comfort. Write for full details. Ask for the address of your Harter dealer. HARTER CORPORATION, STURGIS, MICHIGAN.

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STEEL POSTURE CHAIRS

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● Today—management faces its crisis! Upon the speed and the wisdom with which its plans for reconversion are set into motion depend both payroll and dividend. Only the efficient can survive!

Complete mechanization, enabling the most productive use of manpower, is of primary importance. Equipment that will do it better, faster, and cheaper is the best insurance for the future.

Lamson Conveyors and Lamson Pneumatic Tubes—engineered installations of these two cost-cutters helped win many an "E" award. The same plants will have a head-start in the race for the consumer dollar—the race that is already starting!

To assist you in your planning, we'd like to send the

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Come inside some of America's greatest industries with us—and see how they will handle the problems of increased output at lower cost.

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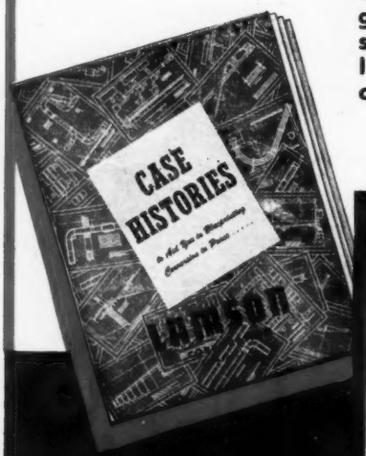


ARMY (E) NAVY

LAMSON CORPORATION
150 Lamson St., Syracuse 1, N. Y.

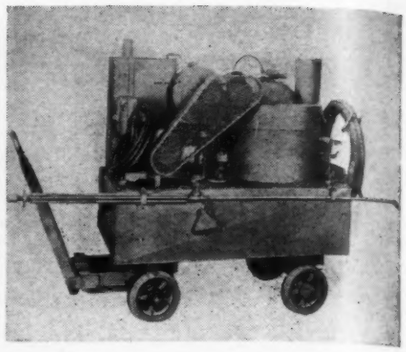
Please send my copy of your reconversion booklet. I'm willing to learn what your planning assistance has done for others.

Name..... Position.....

Company.....

Address.....

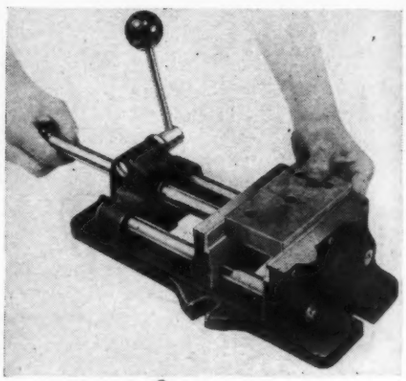
City and Zone..... State.....



vided by one electric motor, which operates on 110-220-volt single-phase a.c. Because of its flexibility of steam pressures, the equipment may be used for many different types of light and heavy-duty cleaning. All moving parts are enclosed and run in oil, and the unit operates without vibration. Features simplicity and ease of operation and maintenance; steam generation of 100 pounds pressure in 1 minute, 200 in 2 minutes; 80-gal. solution tank capacity; operation of two steam guns simultaneously; and safety against fire. Oakite Products, Inc., 14A Thames St., New York 6.

Vise

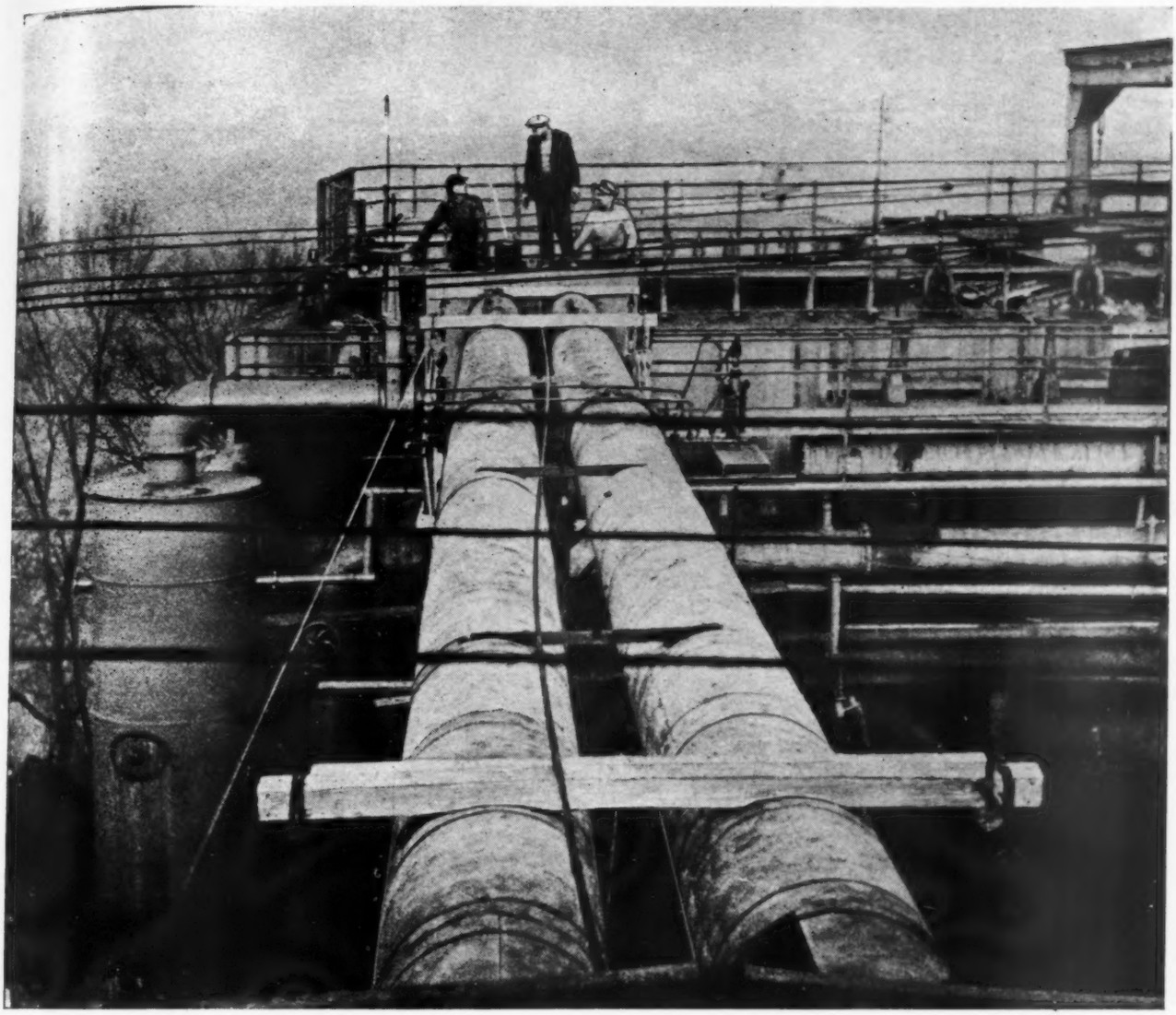
Instead of an adjusting screw, the Heinrich Grip-Master vise has a movable jaw, which can be quickly adjusted to the work with a push or pull on locking-bar knob. Locking lever secures the part. The bars and locking mechanism are hardened, then precision ground. Wide clearance between jaw



guides permits drilling right through the work, and prevents interference from accumulating chips. Jaws have built-in recessed parallels. Removable V-jaw accessory facilitates drilling of round pieces. Vise comes in four jaw-widths, 3, 4, 6, and 8 inches. National Machine Tool Co., 1526 Clark, Racine, Wis.

Temperature Control

For batch-type processes and other operations where rate of temperature increase or decrease must be controlled, as well as the actual processing temperature and duration, the CycleLog controller has been developed. Controls and records all the steps of a complete process cycle. No time-cams or supplementary instruments are employed. Control is automatic, according to whatever schedule



HOW FIBERGLAS* BEAT THE WEATHERMAN

Predictions of "continued cold" can mean serious trouble—unless pipes are adequately insulated. Fiberglas Industrial Insulation, furnished in forms to meet every interior and exterior requirement, is helping industry avoid the costly effects of weather changes and extremes.

During a natural gas shortage, a West Virginia concern built its own gas-producing unit. Efficient operation was aided by the application of Fiberglas insulating blankets, pipe covering and insulating cement. Moisture condensation in two 18-inch gas lines, which had caused severe pressure drops, was eliminated by insulating more than a mile of lines with Fiberglas pipe insulation. And this same highly efficient thermal insulation, installed on outside water lines, prevented freezing.

The illustrated booklet, "Fiberglas Insulations for Industry", will give you complete information about all of the forms of Fiberglas Industrial Insulation materials. Write for your copy today. Find out how this better material can help you "beat the weatherman" and save money. *Owens-Corning Fiberglas Corporation, 1861 Nicholas Bldg., Toledo 1, Ohio.*

In Canada, Fiberglas Canada Limited., Oshawa, Ontario.

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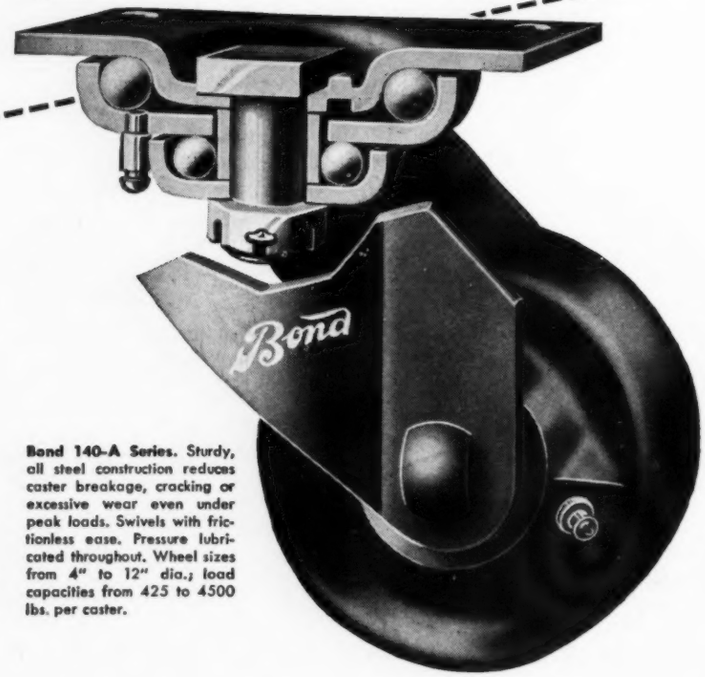
Bond 136-A Caster. Combines easy swiveling with long service. Special double ball race design ...built of durable Bond Caster metal. Pressure lubricated throughout. Wheel sizes from 4" to 12" dia.; load capacities from 600 to 1700 lbs. per caster.

You need the right casters to do your job right! Every Bond REG U.S. PAT OFF built-for-the-job caster is engineered for efficient, economical, long-life service. Select the right casters for your jobs from the Bond REG U.S. PAT OFF catalog K-36—sent free.

BOND FOUNDRY & MACHINE CO., MANHEIM, PA.



Bond 140-A Series. Sturdy, all steel construction reduces caster breakage, cracking or excessive wear even under peak loads. Swivels with frictionless ease. Pressure lubricated throughout. Wheel sizes from 4" to 12" dia.; load capacities from 425 to 4500 lbs. per caster.

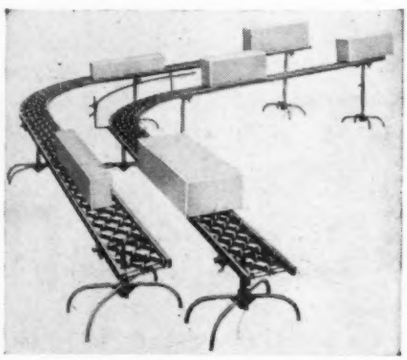
is predetermined by adjustments of four setting knobs on instrument panel. Brings temperature up from any starting point to the desired holding point, and at any rate of rise from 1 to 8 deg. F. per minute. Holds the correct temperature for the required period of time, then shuts off heat supply, and signals operator that the cycle has been completed. The Foxboro Co., Foxboro, Mass.

Solvent Cleaner

Grease, oil, carbon, grit, and miscellaneous shop dirt can be removed from metal parts with Solvent No. 2. Compounded to give maximum cleaning strength in operation, manufacturer states that it does not harm metal surfaces or operator's hands, and its odor is clean and free of toxic and irritating fumes. Completely miscible, the product combines in kerosene or other hydro-carbon diluent, and removes soil from work by solvent cleaning action. Properly diluted with water, it is also applicable as a presoak prior to electro-cleaning to remove tripoli, rouge, and similar buffing compounds. Available in 15- and 55-gal. drums. The Optimus Detergents Co., 270 Church St., Matawan, N. J.

Portable Conveyor

Designated Load-Veyor, portable conveyor combines strength and light weight. Units are reversible so that either side may be utilized. One side may be employed for the moving of large packages while the reverse side conveys small packages, with side members acting as guide rails. Ribbons of steel



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SHAKEPROOF *"Engineered"* LOCK WASHERS PROVIDE THE CORRECT LOCKING POWER . . . FASTER, LOWER COST ASSEMBLY!

Don't be satisfied with just any lock washer. Let Shakeproof engineers give you the benefit of their years of experience in analyzing and solving the fastening problems of leading metal-product manufacturers. If you have applications where lock washers are used in large volume, a special type designed to meet your particular locking needs may improve performance and facilitate assembly. Often, the locking teeth can be "built-in" to a part—definitely reducing costs. Decide now to contact Shakeproof for a study of your lock washer requirements.

DISCUSS YOUR FASTENING PROBLEMS WITH SHAKEPROOF

SEND FOR FREE TEST KIT!

The Shakeproof tapered-twisted tooth locking principle provides positive protection against the loosening action of vibration. With this sample kit which contains various sizes and types you can quickly prove its outstanding efficiency. Write for Kit No. 21, today!

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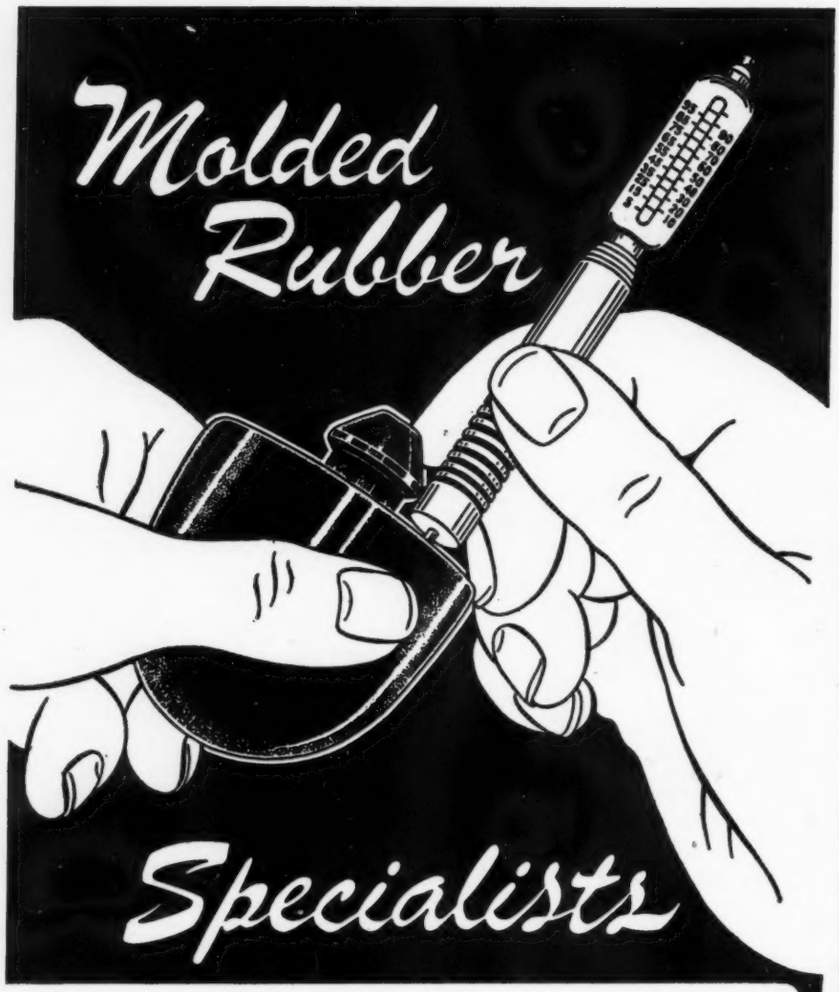

BECAUSE Continental has specialized in molded rubber products for over forty-three years, you will find them of real help in working out the correct design, the preferred compound and the proper method of manufacture.

When you have molded rubber problems consult your Continental branch, or write direct.

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Cincinnati, Ohio	Hartford, Conn.	Milwaukee, Wis.	San Francisco, Cal.
Cleveland, Ohio	Indianapolis, Ind.	New York, N. Y.	Syracuse, N. Y.

★ *Continental also manufactures extruded and lathe cut goods, as well as a complete line of hose, packing and other industrial maintenance items.*

SEE OUR CATALOG IN SWEET'S

CONTINENTAL RUBBER WORKS
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support the ball-bearing rollers on both sides in rigid grid-like construction. Removable connectors or couplings are available to simplify assembly of conveyor unit. Rollers are furnished with hardened inner and outer ball-bearing raceways. Parkerizing and oil treating process protects rollers from corrosion, and they are tightly riveted to grid, to prevent loosening from hard usage. Conveyors also are available in aluminum or stainless steel. Market Forge Co., Materials Handling Div., Garvey St., Everett 49, Mass.

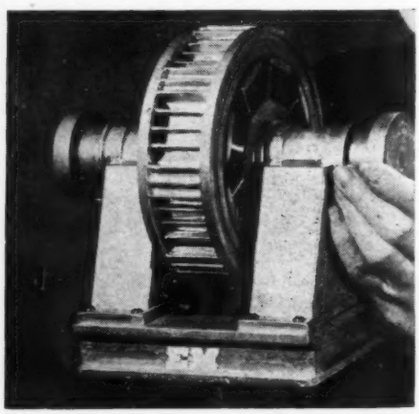
Truck

All-magnesium alloy truck is said to weigh 103 pounds less than the same truck made of steel, and ¼ less than aluminum. The truck, a Push-E-Z model, has capacity of 6000 pounds. Lightweight feature allows

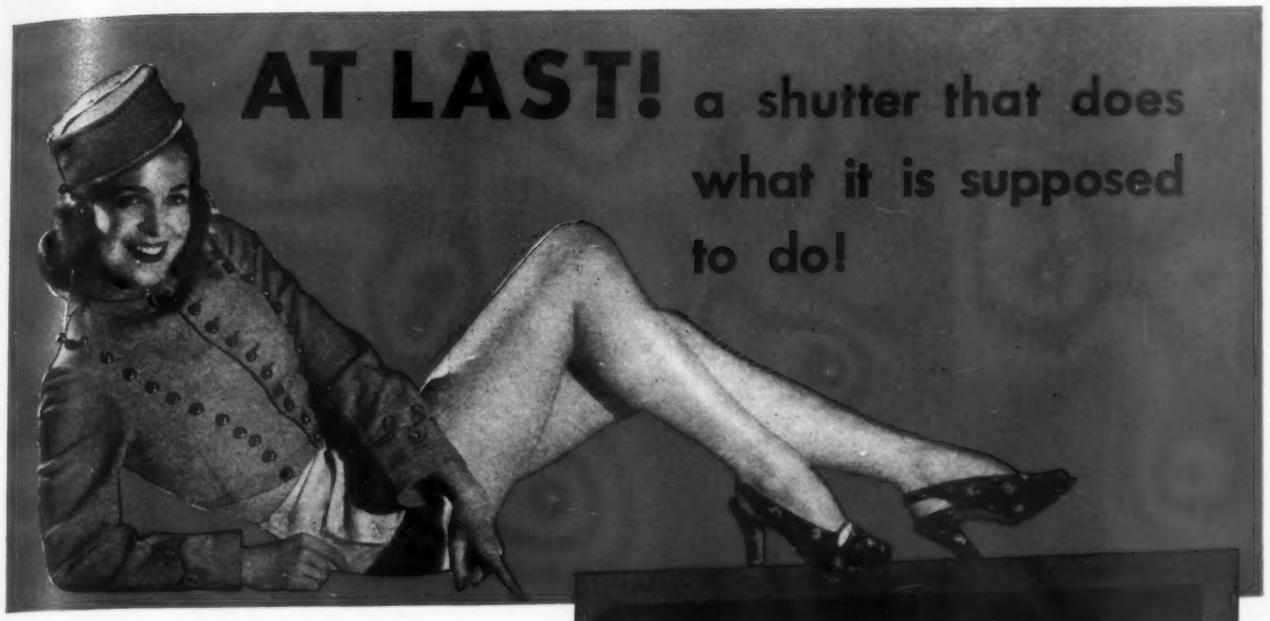
increased pay loads, easy operation, and less physical fatigue in materials handling, according to the manufacturer. Service Caster & Truck Div., Domestic Industries, Inc., Albion, Mich.

Adjustable Speed Drive

Precise wide-range quick-response speed control, for boiler draft fans, centrifugal pumps, blowers, and compressors, is said to be provided by magnetic adjustable speed drive. Consisting of two operating parts, a rotating ring and a rotating magnet, the magnetic drive is a compact self-contained electromagnetic torque transmitter used with a constant speed a.c. motor and an electronic controller, to provide split-revolution speed control. Built in ratings approximately 25

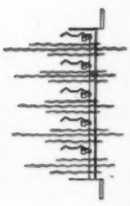


AT LAST! a shutter that does what it is supposed to do!



OPENS TO 90 DEGREES TO LET AIR OUT

The Air-Flo is the only shutter that opens full width to let out all the hot or noxious air.



CLOSES FIRMLY TO KEEP AIR OUT

Unwanted outside air cannot enter through the Air-Flo shutter to chill the plant.

PERFECT CIRCULATION IS ASSURED

Proper air circulation improves working conditions and speeds production. Because the Air-Flo shutter opens to a full 90 degrees when blower fan is operating, all the unwanted air and fumes are removed. The revolutionary new design of the Air-Flo shutter permits for the first time peak efficiency from the fan, does away with exhaust capacity loss. When fan is not operating, the Air-Flo shutter stays tightly closed, preventing drafts and heat loss.

AIR-FLO PERFORMANCE COSTS NO MORE

Architects, Ventilating Engineers and Plant Managers will want to specify Air-Flo shutters for all new construction and remodeling jobs. Although superior in every way, Air-Flo shutters cost no more than ordinary shutters. Write today for prices on the sizes you need.

*Patent Applied For

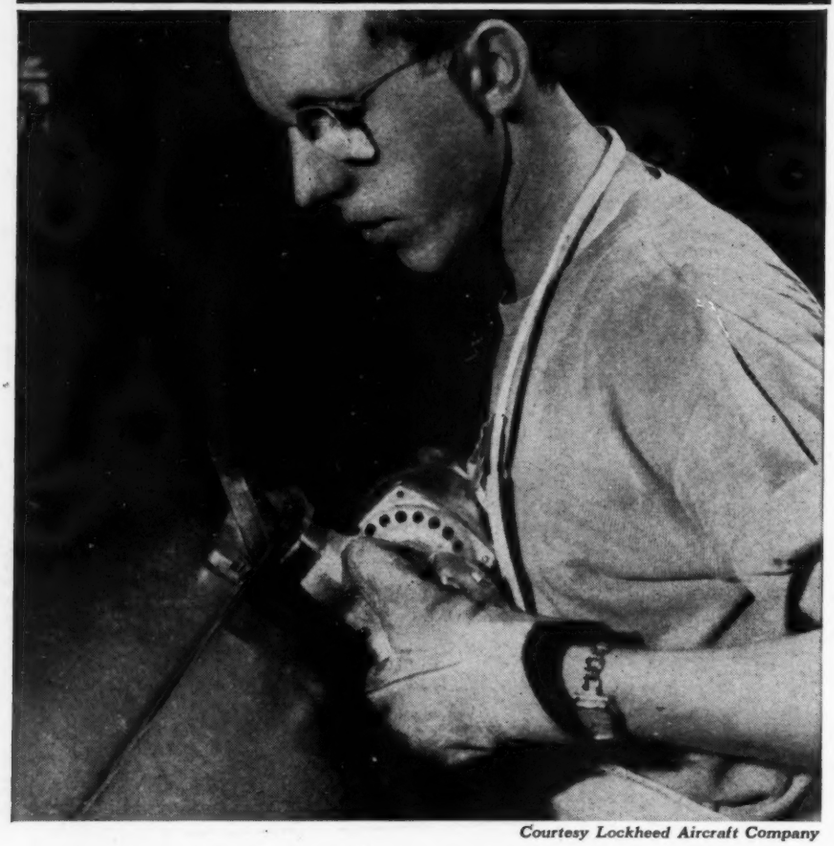
WRITE FOR DESCRIPTIVE FOLDER

We have prepared an illustrated folder describing the revolutionary principle that makes Air-Flo shutters so amazingly efficient. Write for your copy today.

AIR CONDITIONING PRODUCTS CO.

2344 W. Lafayette Boulevard • Detroit 16, Michigan

UNISHEARS cut it to fit the job . . . on the job



Courtesy Lockheed Aircraft Company

Bulky, hard-to-handle sheets and forms can be cut to exact shape and perfect fit . . . right where they've got to fit . . . with Stanley UNISHEARS. Does everything bench shears can do but more conveniently, without the mistakes that can happen between bench and job.

Stanley UNISHEARS cut all sheet metals . . . aluminum, stainless steel, magnesium . . . cleanly without burr or distortion. Guide easily on tight curves and small angles either at the edge or inside the material (from a punched hole).

UNISHEARS are made in capacities to handle a range of gauges . . . 18, 16, 14, 12 and 8 gauge. Write for full information on the complete UNISHEAR line. Stanley Electric Tools, New Britain, Connecticut.

STANLEY

TRADE MARK

STANLEY UNISHEARS

Electrically Driven Metal Shears

horsepower and larger, at 1800 to 600 r.p.m. It provides power savings by operating boiler draft fans at reduced fan speed for partial fan output, eliminating the need for damper or inlet vane control. Unit can be used with synchronous motors to provide power factor correction. Electric Machinery Mfg. Co., Minneapolis 13.

Air Separator

Moisture, oil, and scale are removed from compressed air by separator, known as Airfuge. Utilizing centrifugal principle, the product features simplicity of construction and operation. Air delivered by the unit is claimed to be 99 percent or more free of contamination. Separator is made of high-tensile iron; interior parts are of corrosion-resisting materials. Bottom is removable for cleaning. Made in three sizes for different capacities and pipe connection sizes. The Swartwout Co., 18511 Euclid Ave., Cleveland 12.

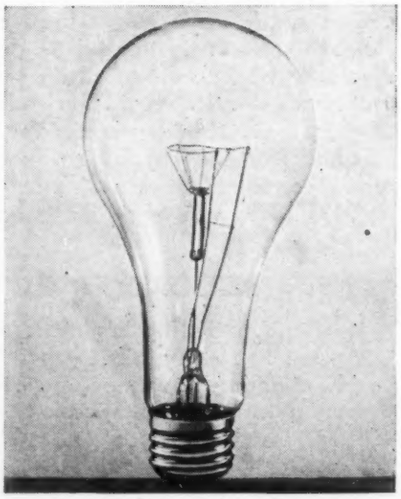
BACK ON THE MARKET

Steel Stools

Individual posture needs are met, helping to increase employee efficiency by reducing fatigue, in steel stools available in five heights and forty models. No. 1226 stool includes all-welded non-breakable construction, adjustable back, and pressed wood seat applied over steel 14 inches wide, with rounded corners, channel brace with foot rest, and steel glide type feet. Back support may be attached to all models. Lyon Metal Products, Inc., Clark St., Aurora, Ill.

Incandescent Lamps

Incandescent lamps, for power plant and industrial equipment service, where there is constant jar and vibration from heavy or high-speed machinery, are again available. Rated at 50 and 100 watts, vibration-resisting filaments for vertical lamp burning are designed to give 1000-hour life. Bulb types include clear and inside frosted. Standard package contains 120 lamps for 115-, 120-, and 125-volt requirements. Sylvania Electric Products Inc., Salem, Mass.



CONTINUOUS PURIFICATION

... SAVES FACTORY OIL

AND REDUCES MAINTENANCE COSTS

CONTINUOUS centrifuging of factory oil has replaced older, more cumbersome methods of oil purification in many metal-working plants. But in some, gravity settling or filtering still "works" — after a fashion. The difference between the results obtained by centrifugal force and by other means is more than one of speed, although centrifuging will accomplish in seconds what may take minutes, hours or, in extreme cases, even days by other methods. Equally important is the ***degree*** of purification.

Oil purified by De Laval centrifugals is so thoroughly purified that its condition can best be compared with that of new oil. Dirt, metallic particles and water are instantaneously removed, the water being continuously discharged to waste. The oil, freed from contaminants, can be used over and over again.

With De Laval equipment, the cost of oil maintenance is minimized. There are no parts which require periodic replacement in order to maintain efficiency of purification. From the start of a run until the moment when the Purifier bowl is filled with dirt, a ***constant*** centrifugal force acts on the liquid.

Bulletin MM lists more than 18 applications, some of which may interest ***you***. Write for your copy.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL

PURIFIER and CLARIFIERS FOR FACTORY OILS FOR GREATER OPERATING EFFICIENCY

"Nothing protects like **RAWHIDE**"

"And there's nothing like **CHICAGO** Rawhide"

Chicago Rawhide hammer faces of coiled rawhide may be quickly replaced in the permanent malleable iron heads.

You can't beat rawhide. Mallets and Hammers made from this tough resilient material deliver the *most* power with the *most* protection . . . preserving fine finishes and expensive machinery.

And *Chicago* is the best in *Rawhide.* Carefully selected hides . . . special seasoning and manufacturing processes . . . Chicago Rawhide's 58 years experience—all give you unduplicated assurance of top-notch resiliency and durability. Always ask for *Chicago* Rawhide Mallets and Hammers.

CHICAGO *Rawhide* MFG. CO.
1300 ELSTON AVE. ★ CHICAGO, ILLINOIS

YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

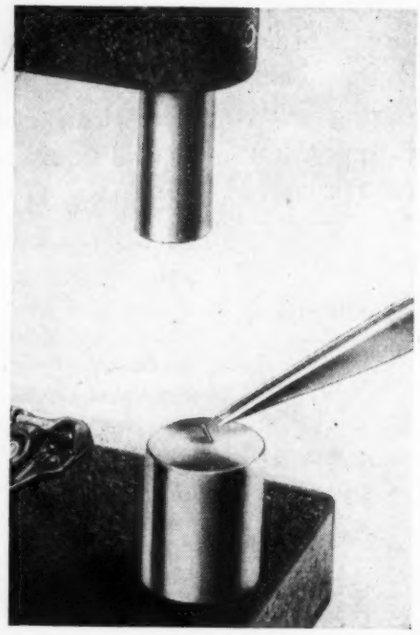
• UNIONIZATION OF FOREMEN opposed by new management organization. Literature available. Foremen's League for Education and Association, May Building, Pittsburgh 22.

• PRIZES for two best articles on welding, appearing in undergraduate publications, will be awarded annually from fund provided by A. F. Davis of Lincoln Electric Co. Authors and publications will share equally in $700 total. American Welding Society, 33 West 39th St., New York 18.

• PRODUCTION SHOW with theme of "Production for Profit" will be presented by scientific, engineering, and technological societies with combined membership of 17,000, on March 20 to 22. Manufacturers' inquiries invited. Chicago Technical Societies Council, 53 West Jackson Blvd., Chicago 4.

• QUALITY CONTROL is major interest of new society inviting applications for membership. Society for Quality Control, 305 East 43rd St., New York 17.

• CASTINGS MATERIAL that sets quickly and can be reclaimed by melting is a combination of ceramic and thermoplastic named "Plastiform." High compressive strength and freedom from shrinkage and warpage are among other characteristics claimed. Duorite Plastics Industries, 8564 West Washington Blvd., Culver City, Calif.



MAGNETIC HARDNESS TESTER simplifies inspection of small ferrous parts and may be used for spot checking of hardness in large sheets or lengths of steel wire. Results are shown on a "go—no go" gage. Meter & Instrument Division, General Electric Company, West Lynn, Mass.

USE OF ALLOY for gage blocks is said to increase their durability yet retain high accuracy as result of character of alloy and elaborate heat-treatments. High acid resistance is additionally emphasized. DoAll Co., 1301 Washington Ave., South, Minneapolis 4

• PLASTICS industry and processes are described in booklet, *Plastics—The Story of an Industry,* to serve public as source of information. Society of the Plastics Industry, 295 Madison Ave., New York 17.

• ELECTRONIC MEASURING of thickness of paint and other coatings is made possible by instrument known as a "Filmeter." Device weighs only 11 pounds. American Instrument Co., Silver Spring, Md.

• WASTE PAINTS, lacquers, and varnishes, may be reclaimed from water-curtained booths by Meckler patented process. Meckler Chemical Corp., 3748 East 91 St., Cleveland.

• ECONOMIC PLANNING is title of booklet refuting theory that a political-economic system half way between capitalism and socialism, called "interventionism," is either possible or desirable. Single copies 3c. Room 522, 630 Fifth Ave., New York.

• STRIKE PUBLICITY portfolio shows how "straight-talk" tactics in news and advertising columns made favorable impression on union members and on the public, bringing the dispute to a favorable end. Copies

BEARINGS RUN *10° Cooler*

SOLNUS OILS...

End High Bearing-Temperatures in Power-Plant

A Sun Engineer was called to a plant where the generator-bearings were running hot, and where oil was being thrown onto the generator-coils. Possible shutdown was foreseen if the oil-throw continued.

After studying the problem, the Sun Engineer recommended a change to a Solnus Oil. With this oil in service, the oil-throw problem was permanently licked, and bearing-temperatures dropped.

This case is just one of hundreds in the Sun Oil files . . . cases in which Sun Engineers and Sun products have teamed up to solve problems, increase production, avoid shutdowns.

In power-plants or on production-lines . . . in mines, mills, factories, foundries . . . throughout industry . . . Sun is helping to increase production, decrease costs. Call your nearest Sun office for full information.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

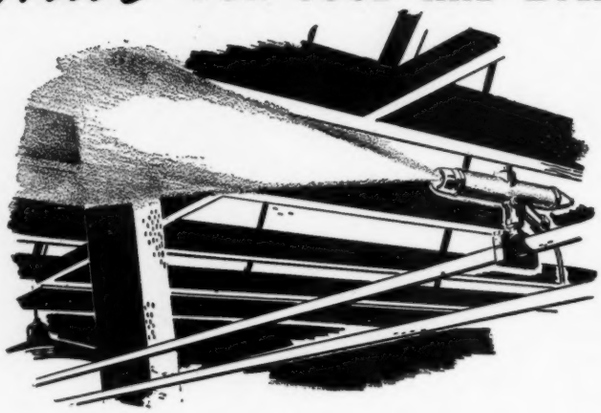
Sponsors of the Sunoco News-Voice of the Air — Lowell Thomas

SUN

SUNOCO

INDUSTRIAL PRODUCTS

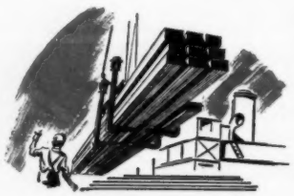
Mist FOR GOOD AND EVIL



Mist, sprayed in process plants requiring high humidity, is vital to the quality of many products. But, it raises havoc with the wood structures. And steam and chemical-laden vapors in wet process plants cause ordinary lumber to go to pieces in a hurry.

Wolmanized Lumber*, wood that's impregnated with Wolman Salts* preservative, is highly resistant to the decay that inevitably develops in these humid atmospheres. Fibre-fixation prevents its washing out or leaching, assures added years of service life.

The Advantages of Building with Wood



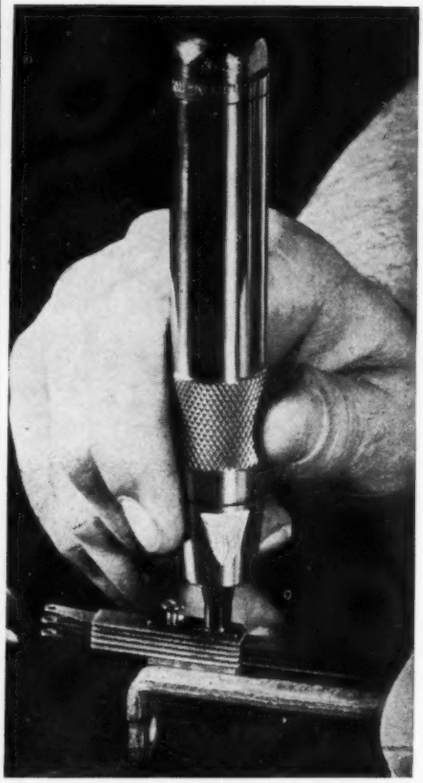
Building with wood means ease and speed of erection, light weight, resilience, high insulating value, paintability, low first cost and . . . when Wolmanized . . . long life.

*Registered trademarks

1676 McCORMICK BUILDING, CHICAGO 4, ILLINOIS

available for other companies. Timken Roller Bearing Co., Canton 6, Ohio.

• SILICONE OILS that flow at temperature as low as 121 degrees below zero. Fahrenheit, have numerous possible applications in industry. Recently developed by General Electric Research Laboratory, Schenectady, N. Y.



MIDGET SIZE in a pneumatic screwdriver is achieved in new model weighing only 8 ounces, and less than 5 inches long. Aro Equipment Corp., Bryan, Ohio

• MATERIALS ANALYSIS for flaw detection and other purposes in metals, plastics, and other fields, is accomplished by a "Hypersonic Analyzer." Brush Development Co., 3405 Perkins Ave., Cleveland 14.

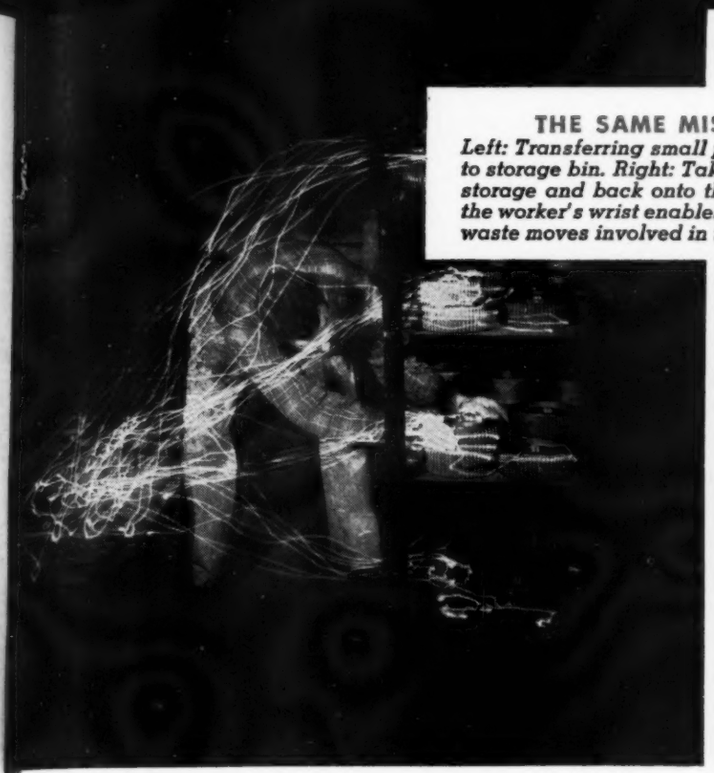
• ALUNDUM ABRASIVE in a special form for use in wet tumbling, cleans, deburrs, and finishes metals rapidly without becoming glazed. Norton Co., Worcester, Mass.

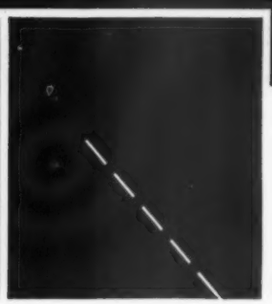
• FEATHERWEIGHT MATERIAL of unusual strength is made of cloth or paper sandwiched between and bonded to thin sheets of aluminum, stainless steel, wood veneer, or plastic. Developed by Glenn L. Martin Co., Baltimore 3.

• TO MEASURE RADIATION from steam and hot water systems, a calculating device registers all factors on a series of disks and automatically delivers the answer. Heat-O-Meter, 424 West 42nd St., New York 18.

• PLASTIC LATEX made with Geon polyvinyl resins, adaptable for impregnation or coating of thread, yarn, string, and wire. B. F. Goodrich Chemical Co., Cleveland.

THE SAME MISTAKE TWICE!
Left: Transferring small parts from platform truck to storage bin. Right: Taking the same parts out of storage and back onto the truck. A light bulb on the worker's wrist enables the camera to follow the waste moves involved in this typical plant routine.





DOUBLE TROUBLE

but it's easy to fix!

No doubt about it: Hand storage methods *are* "double trouble" for the plant owner. For, just as this actual camera record shows, there's a big waste of time and effort when materials go *into* storage—and the same waste repeated when they come *out!*

Happily, there's an easy remedy for storage troubles—Barrett Lift-trucks and Skids. Just leave your materials on skids—right through storage—and you eliminate all the loading and unloading, piling and unpiling. When materials are wanted from storage—*zip!*—a sweep of the Lift-truck handle and they are ready to move out!

The Barrett Lift-truck System brings this same efficiency to all parts of your plant. Inside, in moving materials from room to room or floor to floor; outside, in loading and unloading trucks . . . and with such speed and ease that *one man* with a Barrett does more than *3 or 4!* Ask a Barrett engineer where this system can save for *you* . . . no cost or obligation.

IN OR OUT—*ZIP*—LIKE THAT!
With Barrett Lift-trucks and Skids, storage brings no troubles . . . no waste of time and effort. Your materials stay on skids . . . ready to roll the instant you need them . . . with no reloading beforehand!

See the many places better handling can save you money—in your free copy of the Barrett Junior Catalog!

BARRETT-CRAVENS COMPANY
3261 West 30th Street • Chicago 23, Illinois
Representatives in All Principal Cities
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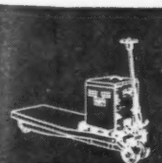
BARRETT

ONE MAN DOES MORE THAN 3 OR 4 . . . WITH A BARRETT

Barrett Handling Equipment



AN
AIR CYLINDER
so different
so flexible
so complete

we call it the
Bellows
AIR MOTOR

HERE is a radically different type of air cylinder — so compact, so flexible, so simple to use, you'll think of a hundred places where it can improve production processes — save time, money and physical effort.

NO SEPARATE VALVES OR CONTROLS TO BUY

Bellows Air Motors are complete power units in themselves, with built-in valve, valve operating lever and stroke speed controls.

NO CUMBERSOME PIPING TO INSTALL

Bellows Air Motors require only *one* air connection which can be made easily and quickly by flexible hose.

INEXPENSIVE TO BUY — ECONOMICAL TO OPERATE

Bellows Air Motors operate on any air pressure up to 175 psi. Model BM5 delivers a power force 5 times air line pressure, Model BM10, a force 10 times air line pressure. Stroke lengths available 1″ to 48″.

Write for Bulletin BM645

The Bellows Co.
SENACON DIVISION
861 East Tallmadge Ave. Akron, Ohio

Significant Labor Developments

BENJAMIN WERNE, Lecturer in Government Regulations, New York University, Member of the New York Bar

Period Surveyed: December 1 to January 1

TREND INDICATORS

Payment of Bonuses Not Requiring Approval

1. *Discretionary bonuses.* Determination as to whether a bonus is to be paid and the amount of this type of bonus lies solely in the employer's discretion. The employee has no claim to such payments unless there has been a previous promise, agreement, or arrangement to pay the bonus. Amounts so paid are therefore not deemed a part of the employee's regular rate of pay and need not be considered in computing the hourly rate of pay or overtime compensation.

The employer may freely grant a bonus in this classification this year, whether or not it be larger than previously, given for the first time, or computed on a different basis, provided price relief is not sought as a result of the payment of the bonus nor costs increased to the government. The payment of these bonuses is treated in the same manner as are general increases. Thus, if a union is present in the plant, the employer should procure the union's consent if he contemplates granting a larger bonus than last year or paying one for the first time.

2. *Bonuses considered an integral part of the base pay.* Bonuses fall into this category when they are promised, agreed to, or arranged for by the employer. The amount so paid may be fixed or determined by application of a formula. Into this category fall such bonuses as those distributed in a certain amount or on the basis of a fixed percentage of the employer's profits or of his gross or net income. Bonus payments of this type are deemed part of the regular rate of pay and must be included in computing the employees' hourly rate of pay and overtime compensation.

The rules applicable for paying bonuses of this type are the same as those applying to discretionary bonuses. Should the bonuses the employer had previously granted come into this category, care should be taken to avoid violation of stabilization laws through an unauthorized decrease in pay.

Discontinuance of Bonuses Requiring Approval

1. *Discretionary bonuses.* If it has been the custom and practice to pay bonuses entirely on the employer's discretion, then he may discontinue the payment *without approval*. However, it is wise to assume that such bonus payments are not necessarily discretionary (discontinuance not requiring approval), because the employees may have been led to believe that they are an integral part of their base pay.

2. *Bonuses considered an integral part of the base pay.* To discontinue or reduce any bonuses in this category, approval must be had. As has been stated, payments of this type are treated in the same manner as awards of increase. Thus, if the bonus is considered an integral part of the base pay, discontinuance or reduction of it without approval may subject the employer to the same penalties as those imposed for illegal reduction of wages.

Whether the bonus is an integral part of the employees' base pay depends, of course, upon the circumstances in the individual case. If the bonus payments do fall into this category, moreover, application for approval should be made immediately.

While the War Labor Board requires approval of all decreases in wages or salaries subject to its jurisdiction, the Salary Stabilization Unit permits a decrease in salary over $5000 without approval, provided the decrease does not bring the salary below $5000. If the latter is the case, the reduction is authorized only where:

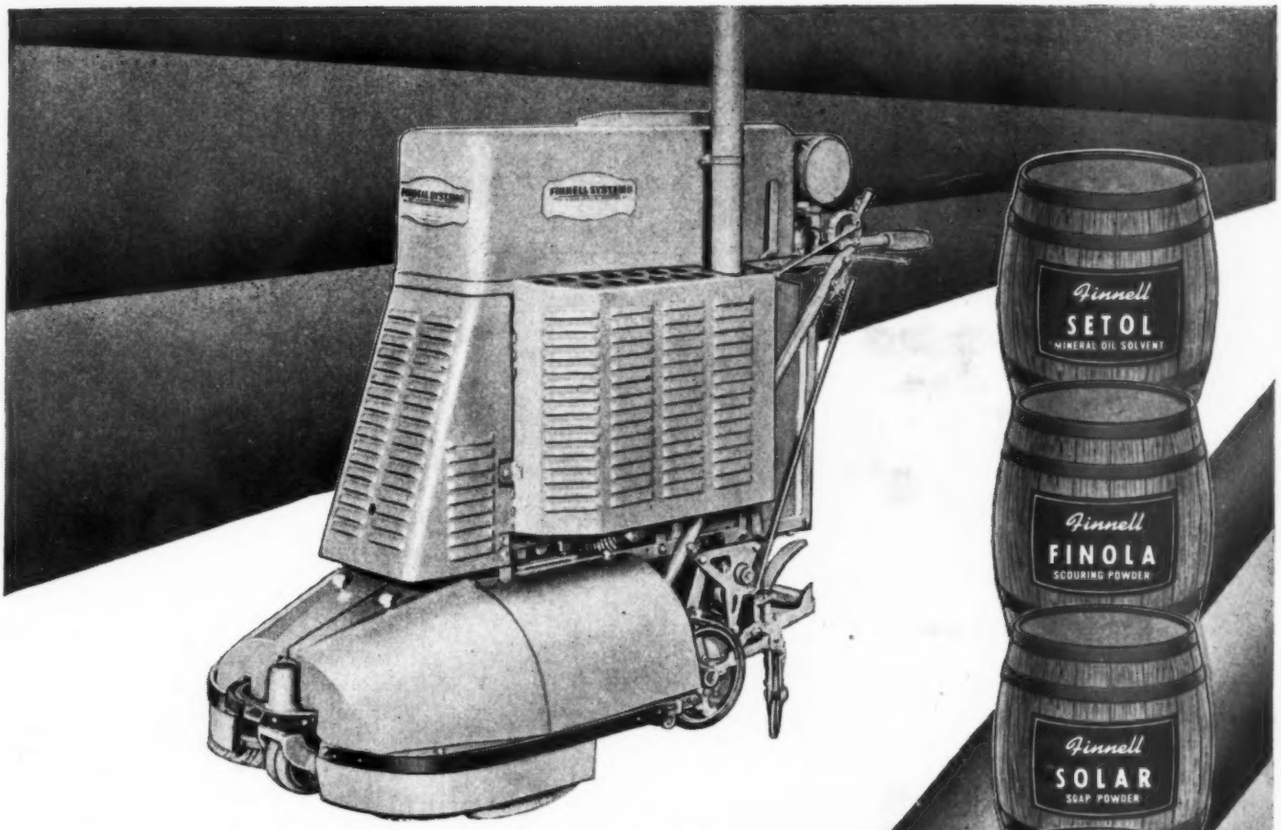
a. The new salary rate does not fall below the highest salary rate existing between January 1, 1942, and September 15, 1942, for the particular work in question or for the same or comparable work in the local area.

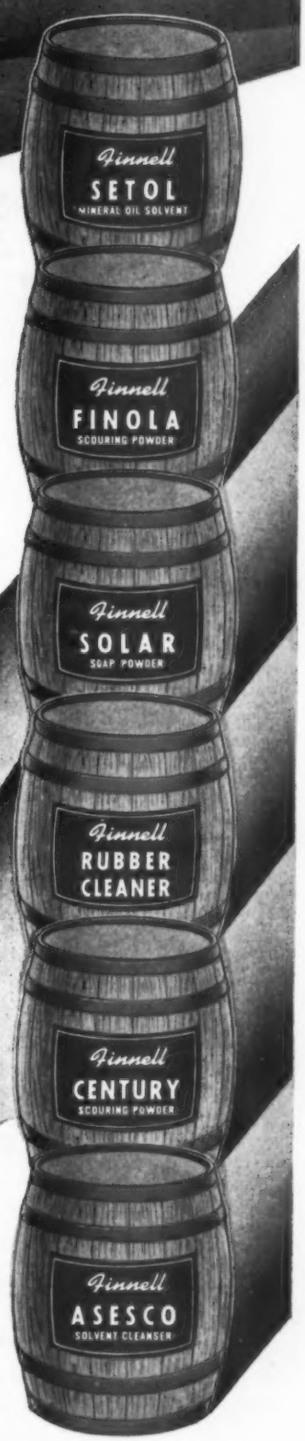
b. An employee has been demoted to a lower position than that filled by him between January 1, 1942, and September 15, 1942, and the salary rate for such lower position is not less than the highest salary rate existing for that position during the same period.

c. An employee has been relieved of substantial duties and responsibilities.

"Retail Establishment" Exemption

On the ground that each physically separate store of a chain of department stores is a separate "retail establishment," an appellate court held exempt from the Act only those employees employed by a chain store system (operating department stores in more than one state) to work in a warehouse adjacent to a main retail store which it serviced exclusively. However, those employees working at its central office, in a bakery and in a drapery workshop, are covered by the Act although they are located in the exempt warehouse. Also those employees in a number of physically separate warehouses





YOUR SCRUBBING MACHINE IS *AS OLD AS ITS MILEAGE!*

So don't waste the mileage of your machine by using slow-actin cleansers. They necessitate prolonged brush action . . . pile up mileage needlessly. Thus the importance of choosing cleansers that keep pace with the speed of machine-scrubbing. *Finnell Cleansers* do—and should—since they're *specially compounded for the purpose.* Their chemical action is *instantaneous!*

Finnell Cleansers are products of *Finnell's own powder mill,* and each serves specific needs. *Setol:* An oil emulsifier for use on mill and factory floors. *Finola:* A scouring powder for heavy duty scrubbing of smooth, hard surface floors and some wood floors. *Solar Soap Powder:* For use wherever a good *soap* powder is required. *Finnell Rubber Cleaner:* For all types of rubber flooring. *Century Scouring Powder:* A mild abrasive cleanser. *Asesco:* An oil emulsifier and water softener. Containers range from 5-lb. bags to 300-lb. barrels.

For consultation or literature, phone or write nearest *Finnell* branch or Finnell System, Inc., 2502 East Street, Elkhart, Indiana. Canadian Office: Ottawa, Ontario.

FINNELL SYSTEM, INC.

Pioneers and Specialists in

FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES

BRANCHES IN ALL PRINCIPAL CITIES

Built-in SAFETY for Hazardous Locations!

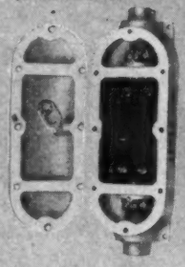
Skilfully designed, ruggedly built Explosion-Proof Fixtures for every location—including the exclusive Fluorescent type—first of its kind in America.

APPLETON
EXPLOSION-PROOF EQUIPMENT
Gives a Wide Margin of Safety!

Here's thorough protection against danger to personnel and property, from chance electric arcs, in oil refineries, chemical plants, and other locations where combustible dusts or flammable vapors are present.

Skilfully designed Appleton Explosion-Proof equipment is well-known for its long, dependable service and efficient operation. Rugged cast malleable bodies are produced in Appleton's own foundries, other parts in Appleton fabricating plants, where their high quality is carefully controlled and maintained. They are approved by Underwriters' Laboratories and conform to all exacting code requirements.

Type ARTC, "SEAL-LINE" Explosion-Proof Circuit Breaking Switch Unilet. Below, cover removed to show roomy wiring chamber with center switch chambers isolated in approved explosion-proof method.



Right, Type OFC Unilet, Explosion-Proof, Dust-Tight, oil-immersed or air-break momentary switch. Removable close-up plug for either dead-end or thru-feed wiring.

PURCHASING EXECUTIVES
Write today for the big Appleton Catalog. Complete descriptions of 15,000 wiring items.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY
1715 Wellington Ave., Chicago 13, Ill.

14 Branch Offices and 7 Resident Representatives in all principal markets

Type FSQX Explosion-Proof and Dust-Tight Receptacle with interlocking safety switch and Type FP Plug.

APPLETON ELECTRIC PRODUCTS

LISTED UNDER RE-EXAMINATION SERVICE OF UNDERWRITERS' LABORATORIES UL

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • RECEPTACLES

were deemed by the court to be entitled to the benefits of the act. (Walling vs. Goldblatt Brothers, Inc., CCA-7)

Held Not "Executive"

Employee spending 95 percent of his time in "routine bookkeeping duties" although he aided in the preparation of the company's income tax returns and wrote letters to other firms concerning past due balances. (Kinney vs. Grieder Machine Tool & Die Company, USDC N. Ohio)

Similarly, the bookkeeper of another firm was deemed non-exempt although his work required knowledge of bookkeeping and recording systems in large industries. The court deemed such requisite knowledge a product of ordinary training and experience. (Giles vs. Gilbert Associates, Inc., N. Y. City Ct.)

Held Under the Act

Miners engaged by individuals who contracted with the company for the right to work certain coal seams abandoned by the company. The company itself participated in the arrangement only in so far as to make periodic inspections and to give occasional advice to the contract holders. The working conditions of the miners were solely in the hands of the contractors. The court not only deemed the miners protected by the Wage-Hour Law but also held the contractors themselves employees of the company. (Walling vs. Woodbine Coal Company, USDC E. Ky.)

Mechanic employed by a local machine shop to recondition and repair machinery of an interstate mining company since his work was "necessary" to the production of coal for interstate commerce and an employer-employee relationship existed between the mechanic and both the machine shop and the mine. The court based its decision on a finding that the mining company owned a major portion of the machine shop's stock, that 90 percent of the latter's work was performed on the mining company's machinery, and that personnel of the two companies was interchanged. (Princeton Mining Company vs. Veach, Ind. Appl. Ct.)

Auto mechanics of a motor carrier, 7 percent of whose business was interstate. The court pointed out that participation of a motor carrier in interstate commerce will not automatically exempt it from the Act. In this particular case the percentage of interstate commerce was too negligible to warrant exemption, and the employer made no attempt to segregate its records so as to show that its mechanics did work a substantial portion of their time on trucks in interstate commerce. The test for such exemption, the court declared, is whether or not in each work week the employee works a substantial part of his time in work which removes him from the Wage-Hour Administrator's domain and subjects him to ICC regulations. (Davis vs. Southern California Freight Lines, USDC S. Calif.)

Guard employed by an interstate textile producer as a deputy sheriff under state law to perform police duties on the company's premises, since he was deemed engaged in the production of goods for commerce. Moreover, the court awarded the employee

35 YEARS EXPERIENCE available to help you LOWER COSTS through improved MATERIAL HANDLING

Aware of present and anticipated increases in manufacturing costs, alert management is now devoting serious consideration to material handling methods. For, while material handling is known to account for an important share of costs, it nevertheless is admitted to be one of the most neglected phases of production.

To assure a highly efficient handling system in your plant, you are invited to consult with MERCURY. As the originator of "The Trackless Train" system of material movement, and a company with over 35 years experience in the designing, manufacturing and installing of handling equipment, MERCURY has the background to render expert advice on the most modern handling methods. For "on the spot" consultation ask a Mercury Sales Engineer to call. Or, if you prefer, write for your FREE copy of Bulletin 7-11. It contains a wealth of handling information, as well as complete specifications on all MERCURY equipment. Write today.

Compact construction, power and easy maneuverability characterize Mercury fork trucks. They are available in capacities from 2000 to 6000 lbs.

Mercury "Jeep" fork truck, 2000 lbs. capacity. Compact size makes it the ideal truck for car loading as well as narrow aisle operation.

Mercury "Trackless Train": Mercury trains of A-310 trailers, powered either by the "Tug" electric tractor, or "Banty" gas tractor, are widely used in the manufacturing and distribution industries.

MERCURY

THE MERCURY MANUFACTURING COMPANY
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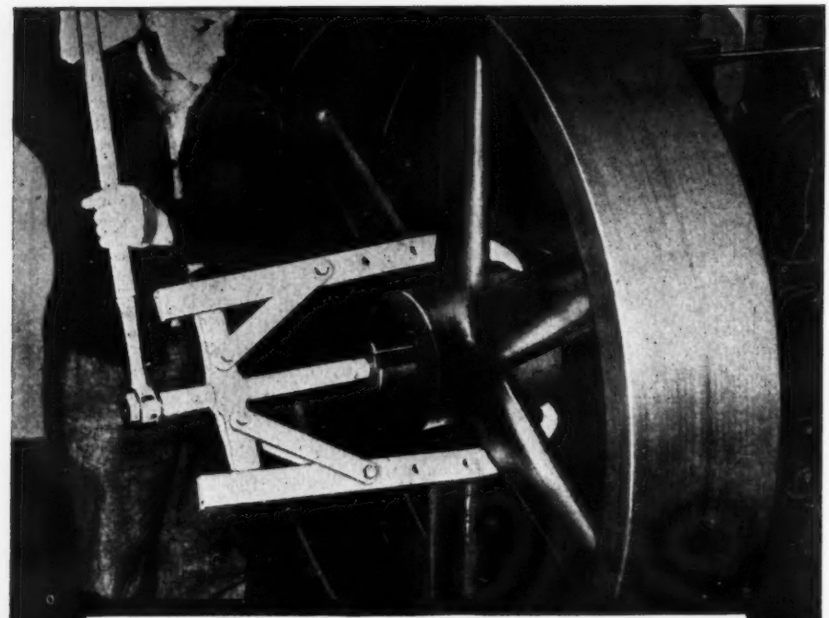

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overtime compensation for 1686 hours and liquidated damages despite the employee's letter stating that he had not worked overtime and that his salary was satisfactory. The court found the letter to have been written under threat of losing his job. (Holme vs. Industrial Cotton Mills Company, Inc., USDC S.C.)

Held Not Under the Act

Watchman of an airport, since the latter is exempt from the Act as a retail and service establishment. The airport confined its activities primarily to the training of pilots for service in the air force, which training did not involve interstate movement. Although other planes did land at the field for servicing, the court deemed such activity negligible. (Rachal vs. Southwest Aircraft Service, Inc., La. Ct. of App.)

WAR LABOR BOARD

* *Veteran Entitled to Back Pay*

A veteran's waiver of his rights guaranteed by statute will not preclude his subsequent recovery of such benefits. Thus a veteran's waiver of his rights to his former job was deemed by the court no bar to his subsequent right to the job upon his withdrawal of the waiver. Upon returning from service, this veteran entered into a mutual agreement with his employer pursuant to which he was to receive a lower-paying and less arduous job than his original position because of service-incurred injuries. Two months later, the veteran requested his former job on the ground that he could by that time fully perform the duties involved. Upon the employer's refusal to reinstate him in his former position, or in one of like seniority, status, and pay, the veteran took the matter to court. The court directed reinstatement to the former position besides awarding the amount of money that the veteran would have received had he been reinstated immediately upon his request. (Laenger vs. Todd Pacific Shipyards, Inc., UCDC W. Wash.)

* *Veteran's Right During Strike*

The time lost by veterans because of strikes occurring during their first year of guaranteed employment is not compensable whether or not the veteran actually participates in the strike. However, where the returning veteran first applies for reinstatement during the time a plant is closed down, his hiring rights accrue from the date he actually resumes work. Moreover, the veteran need not report for work during a strike involving his particular job. (Selective Service Headquarters)

* *Reinstatement of Veteran Ordered*

The fact that company claims to have discovered mismanagement on the part of a veteran subsequent to his induction, is no basis for denying the veteran reinstatement. Nor may the employee's suit for money due him for services rendered the company

*In this and the following classification items marked with an asterisk also are considered to be trend indicators.

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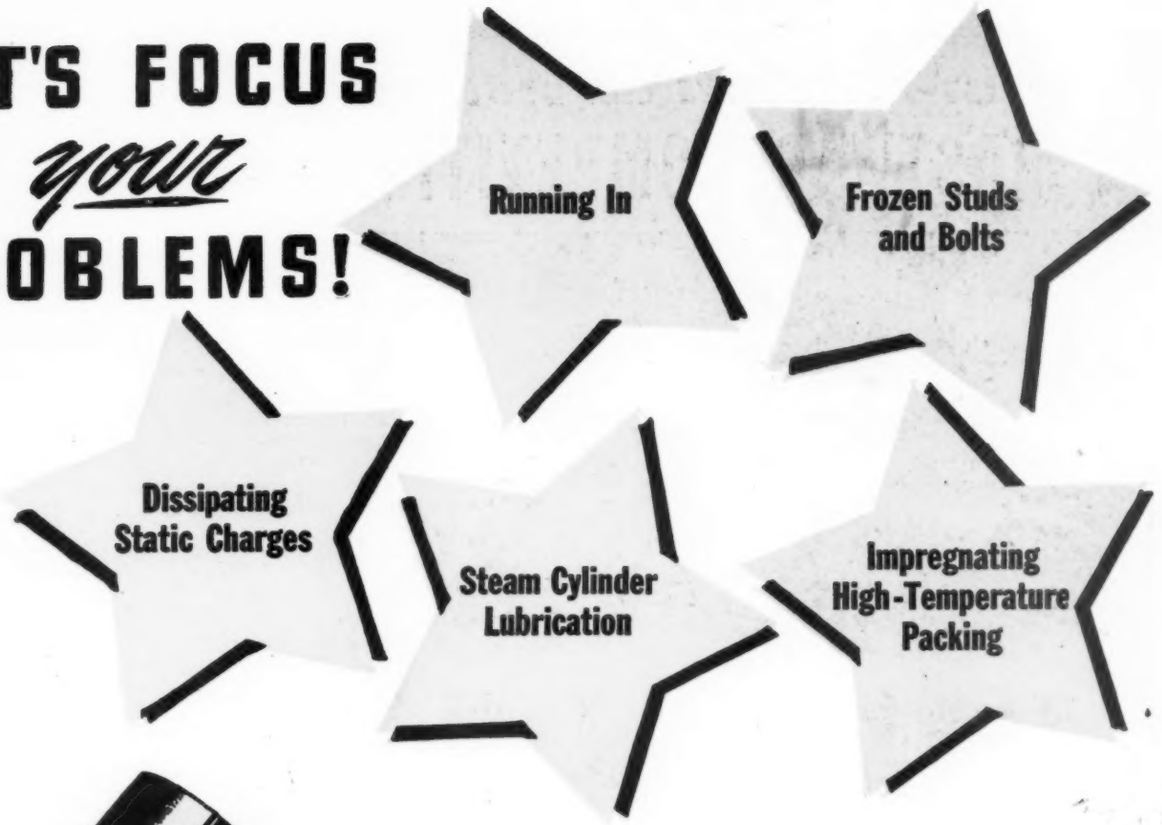

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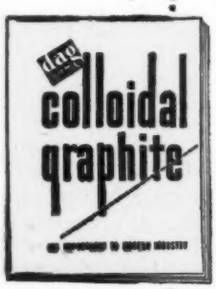

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before he entered service be used as basis for such denial. The court reasoned that if the employee were capable of managing the department before entering military service, the employer had no right to question his ability upon reinstatement. (Anderson vs. Reeves Wholesale Company, USDC S. Idaho)

Wage Controls Continued

Contrary to the previous announcement that wage controls in the building and construction industry will be terminated on December 31, 1945, the WLB now declares, in an amendment to General Order No. 41, that the industry will remain subject to wage control for an indefinite period. Thus, all wage increases and decreases contemplated by the industry must be submitted to the Wage Adjustment Board for approval before they may be put into effect.

* *Equality of Pay*

Applying its equal-pay-for-equal-work principle, RWLB ruled that men taking jobs held by women during the war at rates lower than that paid men for comparable work may not receive more than the rates set for the women. The union had agreed at the start of the war upon dividing the job classifications into "male" and "female" with a 10-cent differential because of the male employees' greater strength and ability to work longer hours. The board now states that this greater strength and ability need not be exerted by those men replacing women and thus there is no reason for their receiving the higher rate. (Nash-Kelvinator Corporation, RWLB-XI)

Board Approval Not Required

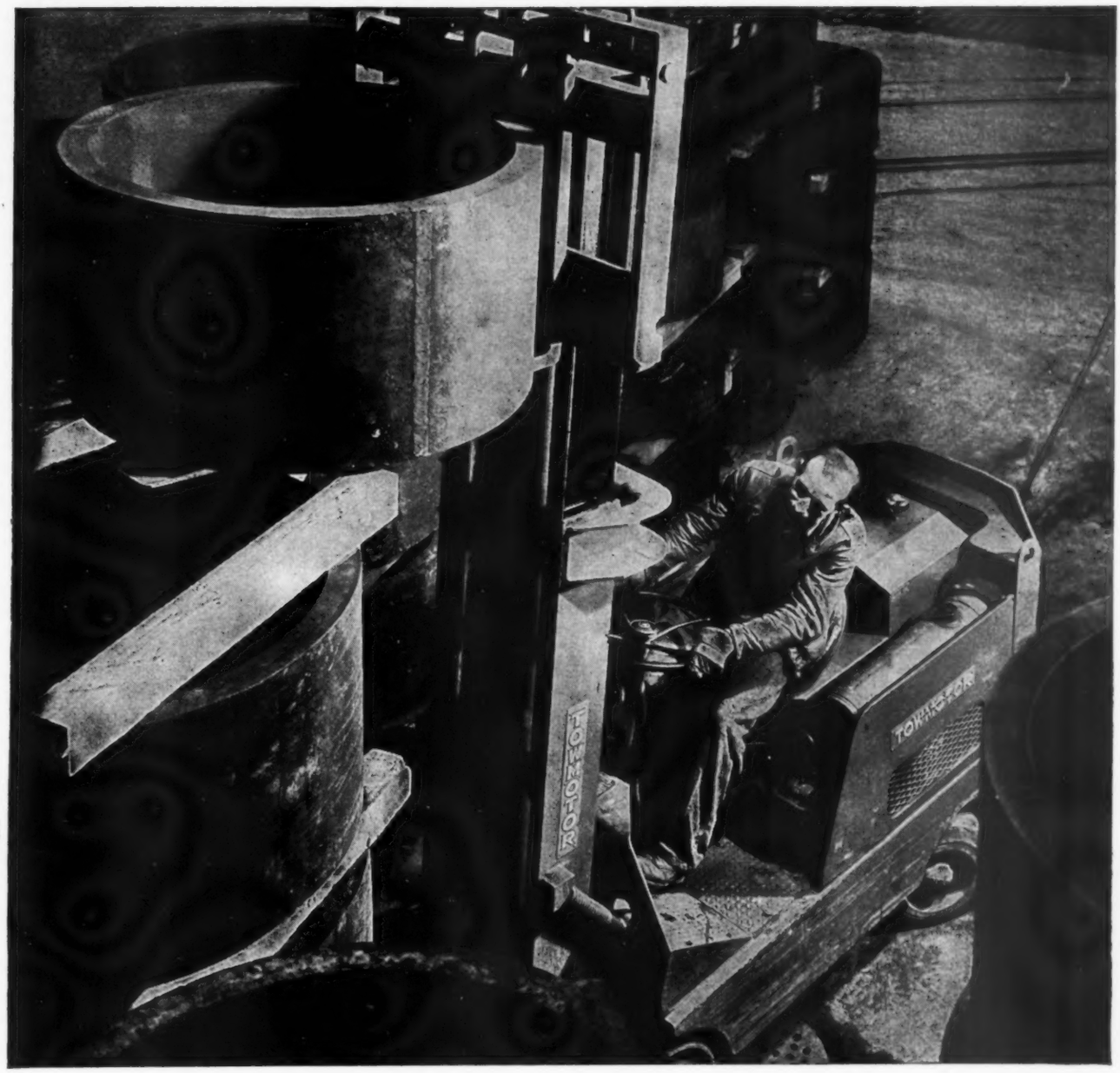
Building contractors working for the federal government need not secure WLB approval before reverting to the old practice of paying double time for overtime in excess of 8 hours a day or for work performed on Sundays or holidays. This is also applicable to private contractors and builders. However, if paying premium rates in excess of those in effect on October 2, 1942, is contemplated prior WLB approval should be obtained.

* *Guaranteed Work Week Ordered*

On the ground that it was the practice in the industry, a RWLB directed a unit of one of the "Big Four" meat-packing companies to establish a guarantee of a 32-hour work week. Although it is recognized policy not to order the institution of a guaranteed workweek in an industry, the regional board explained its order in the light of a previous directive issued by the national board, in which the parent company was ordered to increase its guaranteed work week from 32 to 36 hours. (Wilson & Company, Inc., RWLB-IV)

* *Seniority Clause Enforced*

Application of a company's policy of not hiring employees discharged by another employer, because of failure to perform assigned duties, is barred in the face of a provision in the contract making the rehiring of laid-off employees subject to seniorty. Thus, where an employee has rights under such



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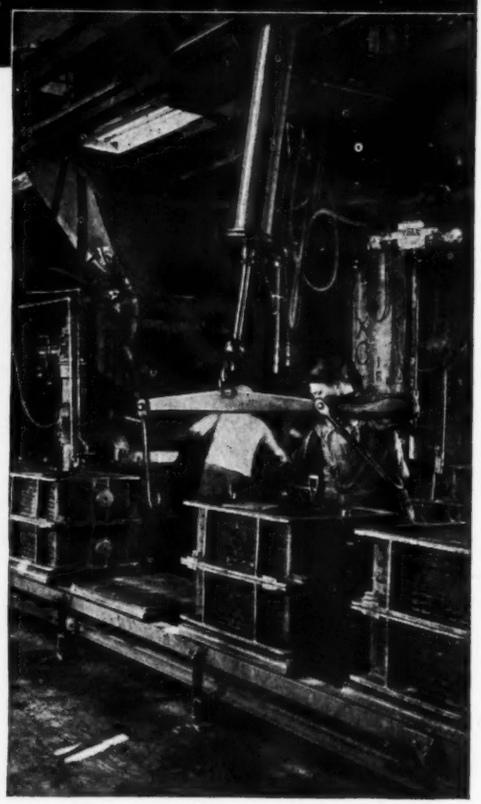

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seniority provisions, he may not be denied reinstatement because he was discharged for neglect of duty on a job taken during the lay-off period. (In re Arbitration between Ford Motor Company and United Automobile, Aircraft, & Agricultural Implement Workers of America, Local 551)

NATIONAL LABOR RELATIONS BOARD

* *Limits Right to Subcontract*

A company's right to subcontract was curtailed by an arbitrator's decision under which the company was ordered not to subcontract where it would result in depriving regular employees of their employment. By virtue of the seniority provisions in their contract, the arbitrator reasoned, the employer must consider the workers' rights paramount to his right to have the work done outside the plant. (In re Arbitration between Du Quesne Light Company and Associated Companies)

* *Economic Strikers Subject to Dismissal*

While strikers may not be discharged for ceasing work because of a current labor dispute, an employer may issue dismissal slips to such economic strikers without fear of reprisal from the NLRB in the form of a back pay award. The board deems such action on the part of the employer a "tactical maneuver." Thus, an employer who sought to terminate the strikers' employment by the use of such notices was deemed not to have violated the Wagner Act; no back pay award was issued, as would have been the case if the discharges were deemed discriminatory. (Majestic Manufacturing Company, NLRB)

* *Reinstatement With Back Pay*

Reinstatement with back pay and full seniority rights was ordered for a union steward discharged for explaining to the employees their rights under the contract, even though such explanation effected disobedience on the part of the employees to a supervisor's orders. Upon being told by the supervisor not to report to work the next day, the steward explained to the employees that the company was obligated to give either 48 hours' notice of no work or one-half-day's pay. To the company's contention that the steward was guilty of insubordination in telling the employeees to disobey the supervisor's instructions, the arbitrator pointed out that he was merely performing his duty as a union official. (In re Arbitration between American Transformer Company and United Electrical, Radio, & Machine Workers of America, Local 415)

* *Back Pay Allowed*

On the ground that foremen are part of management, an arbitrator awarded production employees wages for working time lost during a strike by foremen. Since at the time of the strike, the arbitrator declared, the NLRB considered foremen part of the management and therefore not entitled to bargaining rights, the strike must be con-

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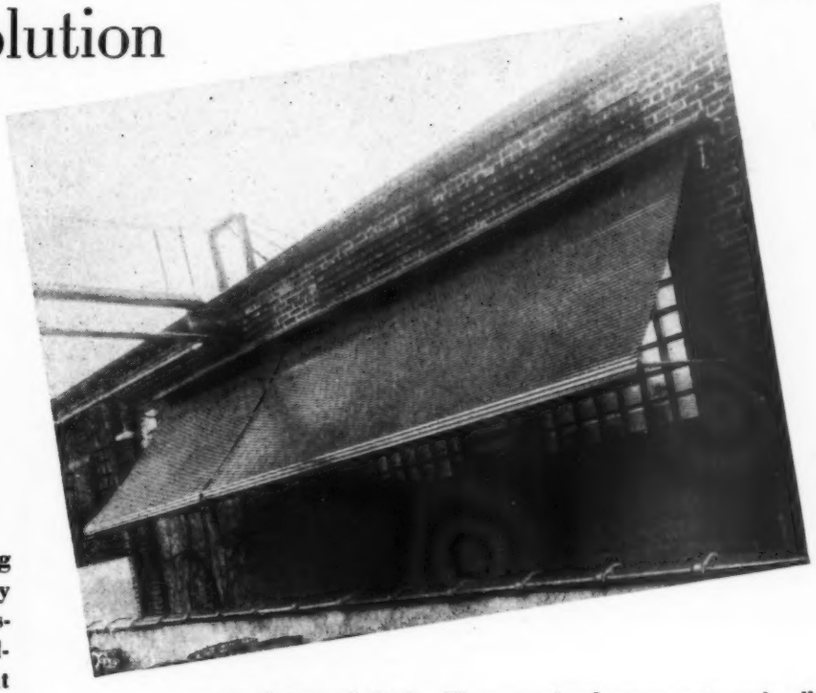

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sidered an act of management, thereby making the latter liable for the wages owed the production employees. (In re Arbitration between B. F. Goodrich Company and United Rubber Workers of America, Local 5)

* *Deduction From Back Pay Award*

In finding that an employee had been improperly discharged under a contract clause allowing discharge for three or more days of unexcused absence, unless a doctor's certificate of illness was presented, an arbitrator ordered the employee's reinstatement with back pay. However, in computing the award of back pay, the arbitrator deducted that amount the employee would not have earned because of probable absences. Heretofore, no such deduction had ever been made in such an award by a governmental agency. (In re Arbitration between Bell Aircraft Corporation and United Automobile, Aircraft & Agricultural Implement Workers of America, Local 10)

* *Increase Subject to Union Check*

Before taking wage adjustment action the bargaining representative of the union should be consulted. Necessity for such action is substantiated by a recent Supreme Court decision in which the court deemed an employer guilty of interference because he applied to the WLB for a wage increase and publicized such action without consultation with the union. Such unilateral action on the part of the employer was frowned upon by the court, although the employer's move was merely a preliminary step to obtaining the "actual increase" and publicized as such. Moreover, the peculiar position of the employer in this instance—i.e., of disputing the NLRB's determination of the unit represented by the union and fearing that it would be deprived of judicial review of the unit should it negotiate with the union, was deemed by the court no defense to its actions. (May Department Stores Company vs. NLRB, U. S. Supreme Court)

* *Severance Pay Denied*

Contractual provision for severance pay in the case of a discharge was set aside by a federal district court because the employees were let go after the plant's bankruptcy. The court declared that such dismissal could not be considered "discharge" within the meaning of the contract, since it was not effected by an intentional act on the part of the employer. Moreover, the court reasoned, discontinuance of the business served to remove the obligation to make payment of the penalty for discharge, in the form of severance pay. (Public Ledger, Inc., USDC E. Pa.)

* *Laid-Off Employees Entitled to Reemployment*

On the ground that the NLRB considers workers laid off as "employees" of the company, an arbitrator declared that employees laid off during the period negotiations on a contract were being conducted are entitled to reemployment in accordance with the seniority provisions of the contract. The arbitrator rejected the company's contention

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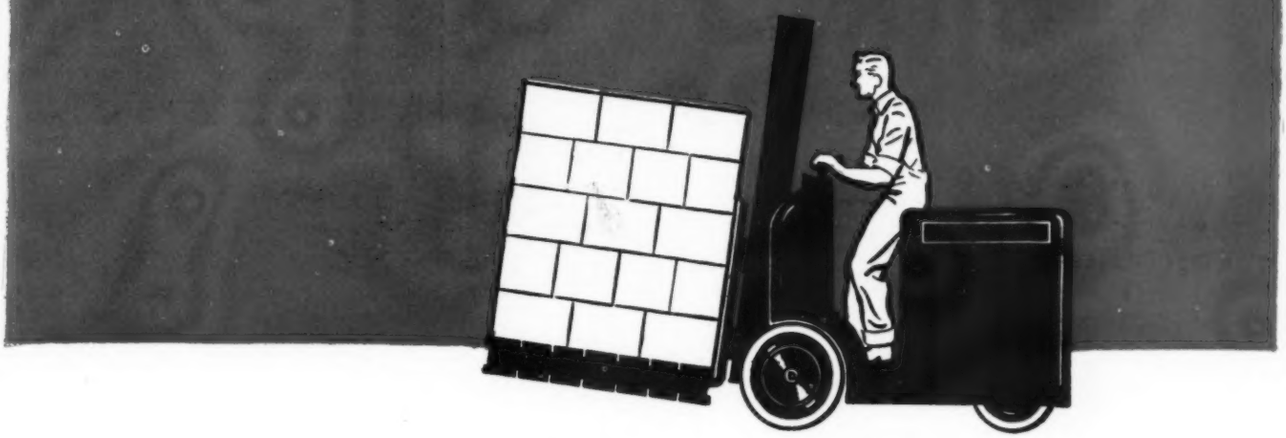

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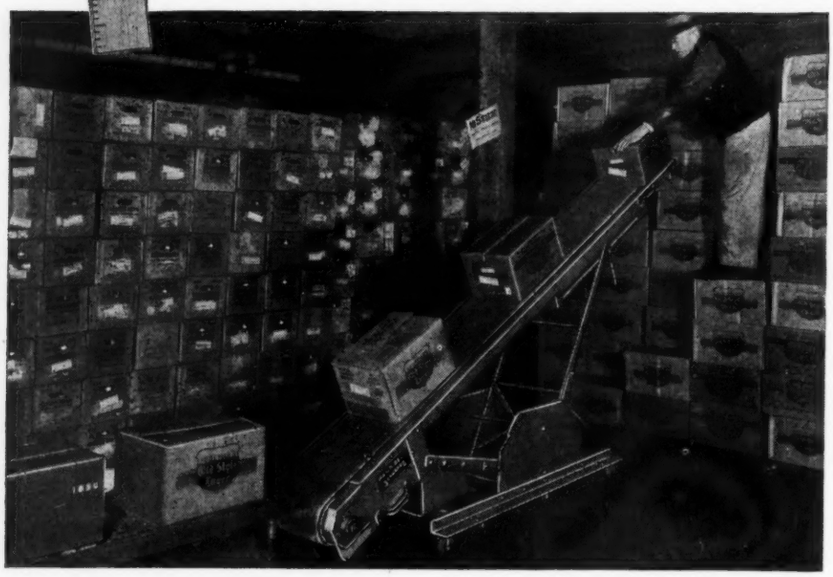

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that only those employees on the payroll on the date of the signing of the contract were entitled to the benefits of the contract, on the ground that union handling the negotiations was acting for all the employees and not merely for those working during the period of the layoff. (In re Arbitration between Dorsey Brothers Trailer Works and International Union, United Automobile, Aircraft, & Agricultural Implement Workers of America, Local 733)

* *Laid-Off Employees Entitled to Vacation Pay*

Declaring that vacations are earned rights and not merely resting-up periods to enable employees to work better, an arbitrator deemed laid-off workers entitled to vacation pay where they were prevented from completing the one year of service requisite to such vacation because of layoff. At the time the year elapsed, the layoff was of shorter duration than the 60 days specified in the contract as the termination date of their seniority status. Thus, being "employees" at the time vacations fell due, they were entitled to their vacation pay. (In re Arbitration between Consolidated Vultee Aircraft Corporation and International Association of Machinists, Aero Lodge 735)

* *Union Officials Liable*

Labor unions may not be sued under the laws of most states, since they are not legal entities. Thus, a corporation was denied any recourse against a union for printing allegedly libelous statements concerning it in the union newspaper. While the union is thus immunized from suit, the individual members of the union can be held liable for the statements made and so sued on an individual basis. (Pullman Standard Car Manufacturing Company vs. Local Union No. 2928 of United Steelworkers of America, CCA-7)

* *Discharge Not Discriminatory*

An employer who discharges an employee because he was not in good standing in the union with which he had a closed-shop agreement, cannot be charged with discrimination when he did not know that the employee had been expelled because of dual membership. Nor was the employer under any duty to inquire into the reason for the loss of good standing in the union. Discharges by an employer on demand of a union holding a validly made closed-shop contract, because of activities by the employees on behalf of a rival union at a time when a question concerning representation was pending, are discriminatory and therefore violations of the Wagner Act, provided the employer knew of the reasons upon which the union's request was based. The fact that the employer knew of the employee's activities on behalf of the rival union at the time the question of representation was pending does not mean, according to the board, that the employer must have concluded that the contracting union was motivated by such activities and not by lawful considerations in demanding that the employee be discharged. (Diamond T Motor Car Company, NLRB)

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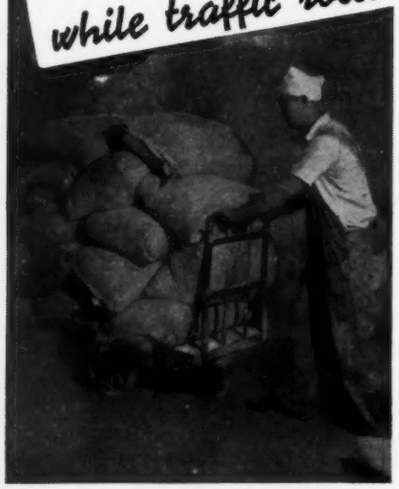

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SMOOTHING THE WAY FOR INDUSTRY'S FLOOR TRAFFIC

DURA-TRED COMPANY

363 N. Central Park Blvd., Chicago 24, Ill.

THEY SAY AND DO

Temporizing With CIO Will Not Solve Issues

FRANK RISING, General Manager, Automotive & Aviation Parts Manufacturers, Inc., in "Memo to Management"

Desperately anxious to avoid the fate of the Knights of Labor, angered by the collapse of a dream power, the CIO will subject the nation to a period of terrorism. Disintegration both moral and physical affects the organization, and its only thought is the use of vicious, unjustified strikes. It will fail, not because of any particular brilliance on management's side, but because the public is nauseated by the display of childish, mean, selfish tactics.

The stampede which CIO expected to develop in industry and government after the threat of "30 percent or else" just didn't happen. I think that a major reason why the country was not stampeded can be found in the crude, crass, stupid tactics of the CIO spokesmen. It is almost incredible, for example, that the hysteria in CIO councils should be such as to produce, in answer to that well-reasoned, straightforward statement by Ford the other day, the charge that the company "was trying to perpetuate starvation wages."

Having failed to show a case in logic, afraid of public opinion but more afraid of losing their jobs to militant opponents within the union, the present spokesmen for CIO arrogantly order reconversion to be stopped. Their situation is something like that of a football team on the fourth down with 30 yards to go and time running out. Every man on the team is trying to play quarterback, and everyone fumbles. The hidden-ball play has failed, and the triple-reverse has gone sour. The stands are beginning to boo, and on the bench a group of smarter players with AFL or Independent on their jerseys are anxious to carry the ball.

Barring governmental intervention, the strike period looks like a long one. There are still a lot of people who will proclaim that we need higher costs with lower prices, more pay for less work, and general prosperity through sleight of hand. But slowly and painfully the awkward majority is making some headway against the fancy and selfish minority. Congressional committees are beginning to take a real interest in finding what the facts are. And the hard, practical politician can find some food for thought in the results of the Detroit election.

Although reconversion is hamstrung for the time being by CIO, there is still some progress evident in the proposals of a few managements. After years of compromise and patriotic expedience, industrial management now has begun to grasp the problem of collective bargaining and to move for sound correction of abuses. A case in point is Ford's statement to its union and another is Chrysler's. Behind those statements lies a record of 773 work stoppages at Ford (under a union shop and check-off) and 487 at Chrysler plants, during the period of "labor's no-strike pledge." This is a shocking exposure of union weakness, and therein lies the really big problem of collective bargaining with CIO. How can union leaders who have encouraged the faking of hundreds of petty "grievances" train their people to stand for justice and fair dealing? How can union spokesmen who admit that "we have no control" over so-called wildcat strikes, claim to be responsible agents seeking firm and binding contracts?

A Lesson for Liberals

It seems to me that there is an object lesson for liberals in this state of affairs. Most Americans are liberals, for that matter—they like to see the little fellow get a break, they believe in restraining the employer from abusing his employees, they believe in collective bargaining. And it is particularly galling to anyone who hoped for real progress in collective bargaining during the past few years to see the wreck that has been made of it.

Perhaps some employers wishfully think that the unions will disappear some day—but I don't know any, and I doubt that there are very many. Management simply wants collective bargaining to work, and can't make it work under the present conditions. That is the whole management story, in one sentence.

Down to Cases

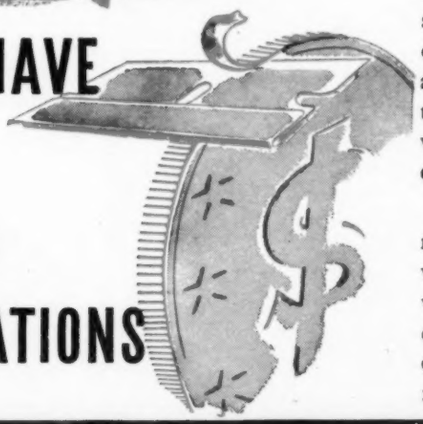
When we get down to cases, our present problem comes to this: We can't make collective bargaining contracts without assurance of responsibilty on both sides. Temporizing further won't do—we can't slide past this crisis without facing another in a few months. We shall have to work it out better this time.

As a first step, we need to define the obligations of the parties to these contracts. These definitions must be strict, and must be rigidly adhered to, and willful violation of the contract should be enough to render it inoperative.

Management must state its own ob-

Perhaps

YOU COULD SHAVE A LITTLE COST FROM A LOT OF OPERATIONS



• **ON EVERY JOB** in the plant where a hand tool is used, there is often an opportunity to cut costs, improve workmanship, promote safety. *On any job* an obsolete or ill-adapted tool is a stubborn slow-downer, a day-after-day waster of time, skill, energy. In the average plant there are hundreds of operations where hand tools are directly affecting workers' efficiency. That is why a methodical, plant-wide replacement of misfit tools with *the right Snap-on for each operation* can contribute significantly to lower costs.

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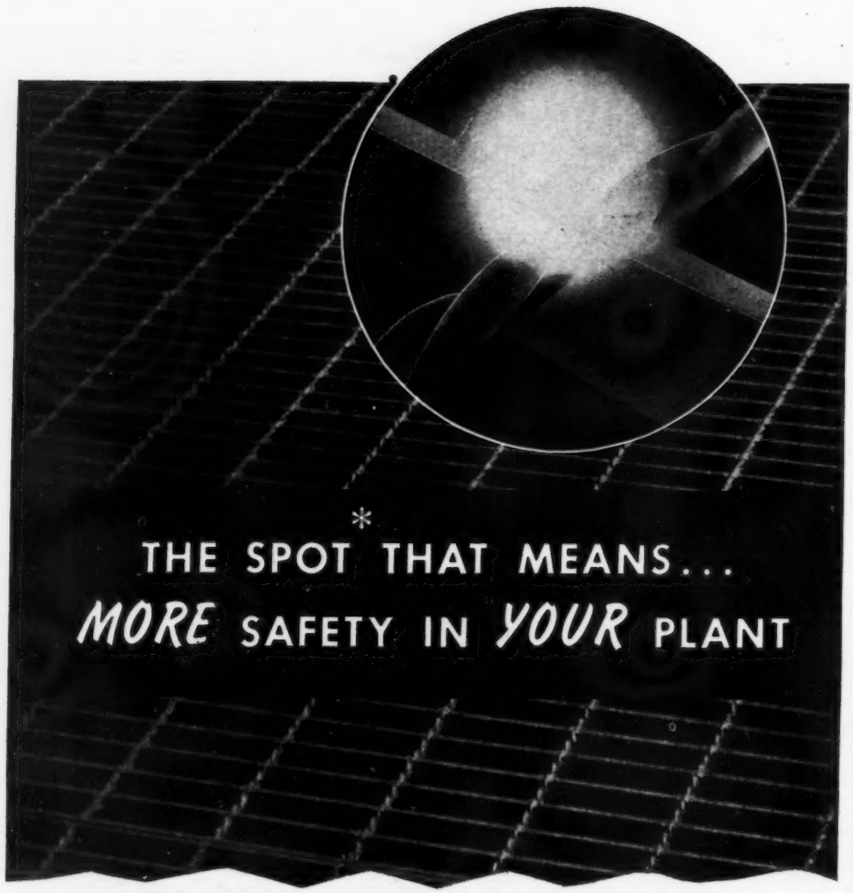

* The illustration expresses the application of heat and pressure used to forge crossbars and bearing bars into one integral unit.

There's a big difference between ordinary grating and Blaw-Knox steel grating safety. For Blaw-Knox is the *only* grating with the electroforged *twisted bar.*

In factories, on cat-walks—see to it that skid-breeding floors are made skid-proof in any weather. Specify Blaw-Knox steel gratings, the only gratings with built-in twisted-bar safety factor.

...AND HERE ARE 5 REASONS WHY

1. **SELF-CLEANING, no sharp corners to clog.**
2. **MAXIMUM OPEN AREA for light and air.**
3. **EASY TO MAINTAIN... paint reaches entire surface.**
4. **STRONG electroforged construction for easy erection.**
5. **SAFE footing at all times with twisted cross bar.**

When further improvement in open-steel floors is called for by changes in business practice—Blaw-Knox will lead as always.

Blaw-Knox Catalog No. 1887 gives complete details on Blaw-Knox Electroforged Steel Grating. Send for it.

DIVISION OF BLAW-KNOX COMPANY
2031 Farmers Bank Building, Pittsburgh 22, Pa.

Seven Blaw-Knox plants have been awarded the Army-Navy "E", and have regularly received renewal stars for continued high achievement in the production of war materiel.

BLAW-KNOX GRATING

ligations, and honor them. And the responsibilities of the union and the employees must be stated and understood not only by the union spokesmen but by all of the union members. This is the only sound basis to proceed upon.

•

Discussing Jobs for Veterans, Production

(Portions of three speeches delivered before the recent annual meeting of the National Association of Manufacturers.)

Job Opportunities for Returning Veterans

GEN. OMAR N. BRADLEY, Administrator of Veterans' Affairs.

In this present-day effort of the American people to strip themselves of war and turn their machines to peace, there lurks the real danger that veterans may be tumbled from the tailgate of this conflict into a nation where glad hands and brave words are offered in place of wartime pledges.

At this time, when the veteran must refit himself to peace, when he must reestablish his home, find a job, and seek to recoup the time he lost in service, he finds himself a victim of the hangover of this war. His chance for recovery is paced to the speed of reconversion.

Where the veteran may be long on the opportunity he hopes to find at home, he is also apt to be short on patience. The post-war world is upon him with a clear sharp meaning. The veteran who has discarded his uniform to hunt for a job is eager to pick up where he left off. If we meet these expectations with honest opportunities, we can build a generation equipped to achieve the unprecedented levels of production and consumption we envisioned during the war. If not, we shall plant a virulent grievance in the hearts of these young men, who may think themselves duped by the promises we have made . . .

Veterans have no illusions of a chromium-plated post-war world. They want to work their way back to a civilian economy again—where fair profits can justify the risk of invested capital and stimulate the production to create more jobs, and where fair wages and adequate security promise the standard of living and margin of opportunity they helped to assure by fighting . . .

Unfortunately, there is a tendency on the part of some people to wrap their responsibilty to veterans in the GI Bill of Rights. Although this bill is a great human document, bringing to veterans of this war benefits that never before existed, it has its obvious limitations. It

Meet Mr. Teach in Your Own Plant

ALL THE PIRATES in history, together, never stole what worn valves are stealing from industry today.

Valves prematurely old from war's overload, as well as valves kept in service beyond retirement age because of scarcity *sometimes* waste costly materials through failure at critical process points – *always* waste money through nursing and repairs.

The sensible thing is to search out these costly valves *before they cause trouble* . . . and replace them with the valves that give you the most dependable operation, at the lowest cost in the long run – Jenkins Valves! Jenkins' craftsmanship, materials and design, are your guarantee of dependability and long-range economy. . . . *But which valves justify replacement . . . ?*

Fortunately, Jenkins Engineers have worked out a fool-proof plan, thoroughly tried in practice, which gives you black-and-white answers on which valves need replacement in your plant. Not an advertising promotion, not "just another set of records", but a sound service offered by Jenkins to help you meet post-war difficulties. Invaluable to management, operating executives and maintenance engineers, yet it does not cost you a penny. It may be one of your answers to post-war economies. Mail the coupon *now* for Jenkins Bros. "VALVE RETIREMENT PLAN" with a set of valve record sheets.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta, Boston, Philadelphia, Chicago, San Francisco. Jenkins Bros., Ltd., Montreal, London.

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For every Industrial, Engineering, Marine Plumbing-Heating Service . . . in Bronze, Iron, Cast Steel and Corrosion-Resisting Alloys . . . 125 to 600 lbs. pressure.

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FREE *Tear it out! Send it in now!*

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Please send me without charge the "Valve Retirement Plan" with valve record sheets.

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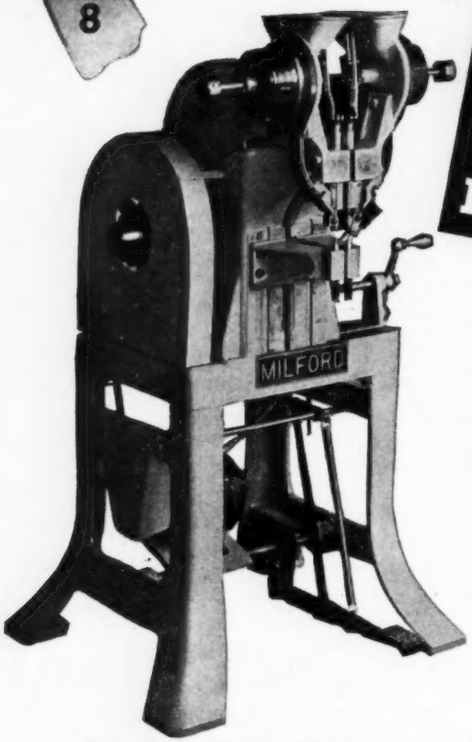

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EQUIPMENT

Semi-tubular
RIVETS

Rivet-setting
MACHINES

Beside the Double Spindle machine illustrated, there are other models, single spindle machines—all of which may be RENTED for seasonal or limited use.

Time checks on products as diverse as wrist watches and automobiles have repeatedly proved that Milford equipment spurs fastening operations. Flattens costs to a shadow of what they were.

Should Milford semi-tubular rivets not seem practical on a particular assembly, Milford engineers can often suggest an inexpensive change that assures the savings from rivet-fastened assemblies.

Moreover, Milford also designs and manufactures special small metal fasteners in endless variety to meet every fastening need and—because of Milford's specialized experience and equipment—usually at most attractive savings. For quotations, send sample or blueprint.

But first, see if Milford semi-tubular rivets (which show even greater savings) won't speed your fastening operations. Send your product for study and suggestions by Milford engineers.

THE MILFORD RIVET & MACHINE CO.
861 Bridgeport Ave. MILFORD, CONN.
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Inquiries may also be addressed to our subsidiary:
THE PENN RIVET & MACHINE CO., PHILADELPHIA 3, PENNA.

Designers and Manufacturers of: SPECIAL COLD-HEADED PARTS; SPLIT, SEMI-TUBULAR AND DEEP-DRILLED RIVETS; RIVET-SETTING MACHINES; SPECIAL MACHINE SCREWS AND SCREW MACHINE PARTS.

does not purport to relieve the American people of their task, but only to help them. It can aid in our effort to reestablish the veteran, but alone it cannot hope to do the job . . .

It is clear that jobs must result from the regular processes of our economy. However, in helping veterans to find these jobs, placement aid may be needed. The philosophy that deployed veterans placement to another agency of government, accepted the ultimate conclusion that the employment problems of veterans are allied to those of the rest of the nation.

And yet in this immediate situation, veterans' employment is distinctive in the urgency that surrounds it. I do not contend that the veteran, by virtue of his wartime service, is entitled to extraordinary privileges from the government or the people that comprise it. Neither do I abandon a principle to which we must hold—that the veteran be given first call on the nation's opportunities to recoup what he lost in service and secure a peacetime start. In fairness to the veteran, we must admit that his problem is not only a difficult one, but also that it is essentially—if temporarily—different from that of the rest of the population . . .

Although many veterans will presumably claim rights to the jobs they held on entering the service, there are also many who feel their Army experience qualifies them for something better. In addition, there are several millions who entered the Army and Navy directly from high school and college, and who have never before held full-time jobs. . .

Within the Veterans Administration, we have a specific interest in employment where it is linked to the jobs provided our disabled veterans of this war. In our rehabilitation training, we seek to develop skills that will compensate them for the loss of other faculties and enable them to become self-supporting citizens, freed from dependence as wards of the government. . .

Training for Veterans

I must also add a word for our able-bodied veterans. In many industries training programs have been established to aid returning veterans in learning occupations so that they may equip themselves for better and constant employment. There is vital need for an extension of this type of training.

If it is not provided, we may find ourselves with the drifters that appeared among veterans from the last world war during our great depression. These men, too, lacked the skills for trades and opportunities on their discharge from service. Without training, they were unable to take their places in competitive

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the products of leading industries
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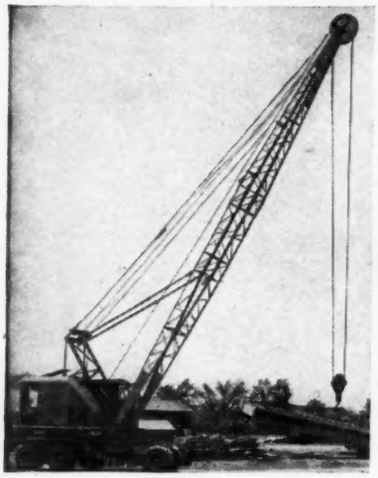
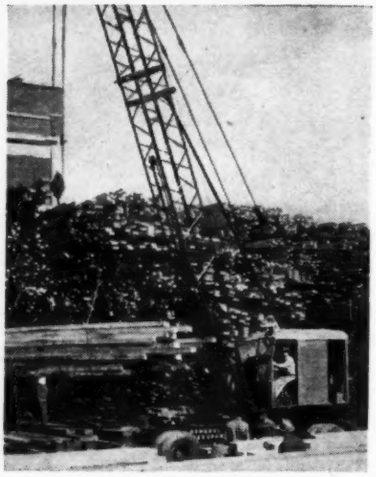
HOW
Are Heavy Materials Moved in YOUR Plant ?

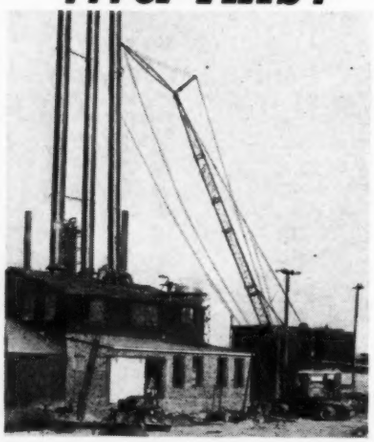
Many industrial concerns find that many lifting and carrying jobs can be handled faster, more economically and safer with rubber-tired Mobilcranes and Supercranes. These one-man operated, one-engine powered cranes are fast and maneuverable . . . may be safely operated in close quarters . . . eliminate tracks and special roadways. In making plans for improved plant efficiency, you'll be interested in learning what the Osgood Mobilcrane and General Supercrance can do for you in modern materials handling.

Do You Have Jobs Like THESE?





. . . or THIS?



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THE OSGOOD CO. MOBILCRANES — THE GENERAL EXCAVATOR CO. SUPERCRANES

MARION, OHIO

industry. Drifting from one unskilled job to another, they were the first to feel a job pinch, the last to benefit when times improved.

By extending our opportunities for vocational training, we can do much to prevent our generation of this war from undergoing similar employment indignities and help instead to make of them useful productive citizens.

* * *

Full Employment *Plus* From Full Production

IRA MOSHER, President, Harrington Cutlery Company

How can we make a frontal attack upon the problem of lasting prosperity —not prosperity for a few, or prosperity for one group or one section at the expense of others, but full and lasting prosperity for the nation as a whole?

You know the answer to that question. It is to be found in just one word —*production*. With full production we can have full prosperity, which means not only full employment but full employment *plus* better wages based upon production; full employment *plus* an ever-increasing standard of living based on a greater output of goods at more and more attractive selling prices; full employment *plus* economic, social, and cultural progress; and, above all, full employment *plus* the preservation of that freedom of choice, both economic and political, which has been, and must continue to be, the fundamental right of every American citizen.

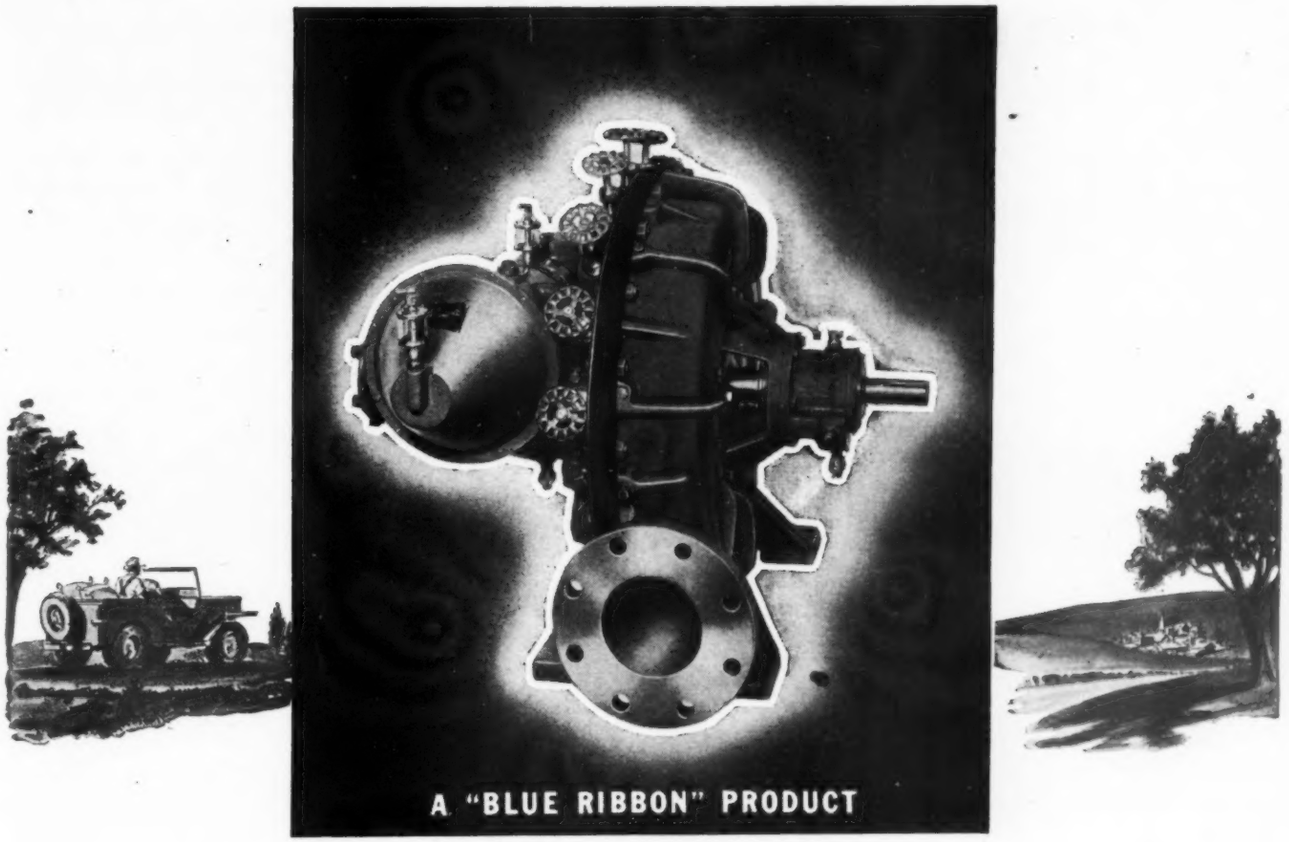
Full production with full employment *plus* is an attainable objective for this nation. It is attainable if we will stop just hoping for it and all of us get down to work. We have the natural resources. We have the raw materials, the labor force, the productive capacity, and the managerial know-how. We have all that it takes to give Americans a prosperity and security without parallel in the history of the world.

First, we must take whatever steps are necessary to assure that there will be an adequate flow of private capital into productive job-making activities. Without such a flow of capital, there cannot be that growth of productive resources necessary to provide jobs for our growing population. Without such a flow of capital, we cannot turn out the increased supply of goods essential to a rising standard of living for our people. . .

If we are to have adequate private investment, therefore, we must have: .

1. A tax system that makes it possible for savings to be accumulated.

2. Government policies, on taxes and otherwise, that do not destroy the will-



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For a small, tough, hard-working turbine that will go anywhere and do all you expect of it . . . get a Coppus "Blue Ribbon" Steam Turbine.

Coppus Steam Turbines come in six frame sizes from 150 HP down to fractional—so you can match more closely your job requirements. Each smaller size is priced correspondingly less, so by selecting "horsepower" instead of "elephant power" you save on investment and installation cost.

Many well-known manufacturers install Coppus "Blue Ribbon" Steam Turbines on original equipment. They know Coppus quality will protect the reputation of their own products. The Coppus Turbine is also being used on many U. S. Destroyer Escorts, all Casablanca class aircraft carriers and 90% of all Landing Ship Docks.

Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.), the Coppus Steam Turbine is a precision-made product, with accuracy controlled by Johansson size blocks. Every turbine is dynamometer-tested before shipment.

More than 85% of all orders since 1937 have been repeat orders.

Write for Bulletin 135-9. Coppus Engineering Corporation, 322 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER. Other Coppus "Blue Ribbon" Products in SWEET'S, CHEMICAL ENGINEERING CATALOG, REFINERY CATALOG.

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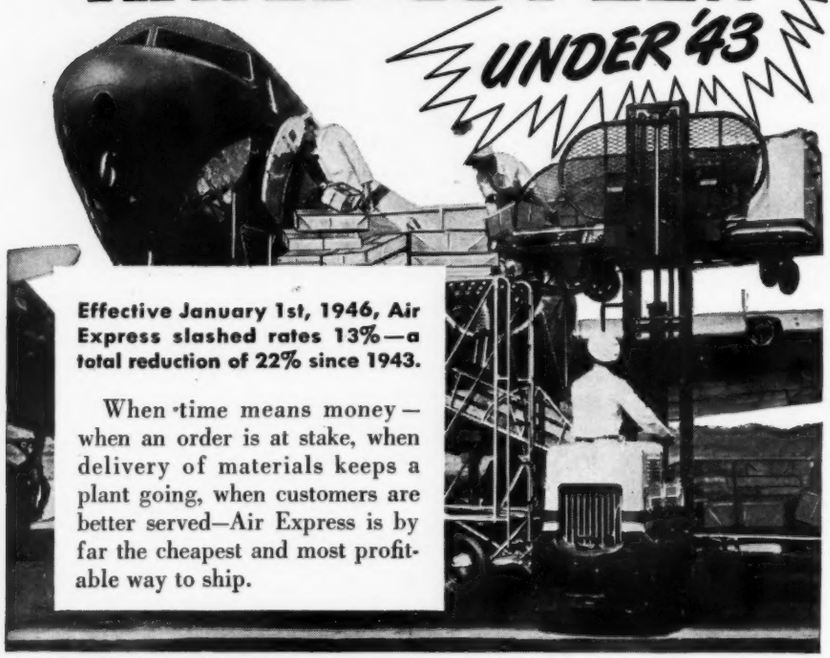

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149	$1.00	$1.00	$1.00	$1.23	3.07
349	1.02	1.18	2.30	3.68	9.21
549	1.07	1.42	3.84	6.14	15.35
1049	1.17	1.98	7.68	12.28	30.70
2349	1.45	3.53	17.65	28.24	70.61
Over 2350	1.47	3.68	18.42	29.47	73.68

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ingness of those with savings to put their funds to active use.

3. A labor policy that does not result in wages taking so much of the gross income of a business that there is nothing left to maintain adequate reserves and to give a decent return to those who risk their funds.

It is important, therefore, that our tax system permit the accumulation of savings to be invested profitably in productive enterprise which will supply jobs and more jobs. Our present tax system needs an intelligent overhauling to accomplish that purpose.

The income tax should be held to a level that will not discourage individual endeavor. Taxes on capital gains discourage production and job-making, and should be eliminated. Taxes on corporate business should be set below the point of discouragement. And a fair method should be devised to eliminate the double taxation of corporate income.

If business is to be the job-maker, it is as important to stimulate its incentives as it is to encourage the incentives of labor.

The second broad line of action which I think we must follow, if we are to reach our goal of full production and full employment *plus*, is in connection with special privileges. . . You know and I know that for years—and I don't mean just since 1933—we have become more and more a nation of special privilege. Sometimes it has been one group which had the inside. At other times, it has been another group. But no matter what group it has been, the net effect has been to create stresses and strains and social irritations. And as the granting and perpetuation of special privileges have extended over more and more of our economy, the underlying situation has become worse and worse, and our economic and political system has become worse and worse, and our economic and political system has become increasingly vulnerable to attack, both from inside and outside.

We have got to clean up this situation! And the only way it can be cleaned up is to get rid of these special privileges. We have got to get rid of not just a few of them, and not just those we don't happen to like, but all of them.

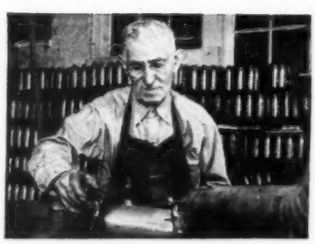
Let me give you a couple of examples of what I mean—and I'm deliberately picking hot ones.

First, there is the question of the tariff. Now I am not a "free trader." I am convinced that the tariff has played a major and constructive part in the development of this country. But all of us know that the tariff can be, and too

Problem ~~TROUBLE~~-SHOOTING *with* SEAMLESS STEEL TUBING

MACHINERY INDUSTRY
THE PROBLEM:
To make—for giant Harris-Seybold-Potter printing presses—a 6-foot ink roller, light enough for easy removal and handling, yet strong and precisely rigid for perfect control of ink distribution.
THE ANSWER:
OSTUCO Seamless Steel Tubing. Here are the light-weight strength, the uniformity and quality which meet the most exacting printing requirements. Interesting too is the fact that famous Harris-Seybold-Potter, customer since 1900, cuts roller manufacturing costs as much as 50% by using OSTUCO swaged tubing.

Printing is one of many industries in which OSTUCO'S facilities and specialized knowledge of steel tubing have helped solve a production problem . . . helped build a better product. It's the kind of immediately available service you may be seeking today. It involves *interested* engineering assistance, time-proven skill and experience*, rigid testing from steel billet to finished tubing, on-time delivery, and an unsurpassed record of low rejects. Write your nearest sales office today for complete information and the valuable FREE booklet "M-1", covering various steel analyses, tolerances and machining methods.



**Meet Philip Keller, of the machine shop, and a member of OSTUCO'S famous 50-Year Club. Loyal, skilled men like Keller, and their sons and grandsons, carry on a tradition of excellence at OSTUCO that dates back to the earliest days of tube-making in America.*

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Standard (Semi-Dust-tight) Enclosure➡

For reduced voltage starting of 220-550 volt squirrel-cage motors these EC&M auto-transformer starters have a reputation for low up-keep cost throughout industry.

As illustrated above, the mechanism is a single, quick-break, double-throw Contactor (C), operated by a single Magnet (M), a throw-over Spring (S) and a mechanical Latch (L) tripped by plunger (P) which is raised by a current-limit relay to cause transition from reduced voltage starting to full voltage running.

Arranged for wall mounting with contactor oil-immersed in removable tank, the auto-transformers and thermal Overload Relays are mounted in the upper part of the case. Unlike conventional thermal relays, this device is of the hot-wire expansion type. It is set to trip at a low value of current above normal full load motor current for accurate overload protection. This can be done without false tripping during the starting period, because the wire is protected from high starting currents by current transformers.

Bulletin 1045-B gives complete ratings and dimensions and also lists three larger sizes of starters for 220-550 volt motors. Write for your copy.

⬅Type VIII Enclosure for Class 1, Group D Hazardous Locations

THE ELECTRIC CONTROLLER & MFG. CO.
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often has been, used in ways which benefit only one small group at the expense of the country as a whole . . .

Specificially, as I see the problem, we should continue to use the tariff to protect our markets against government-subsidized dumping of foreign products and other unfair competition.

Second, we should use either the tariff or subsidies, whichever Congress determines will be the more economical, to assure adequate production of those items essential for national defense.

Finally, in our own self-interest, our over-all national policy should be one of gradual reduction of tariff duties. Such reduction in each case should be continued to that point which will maximize production and consumption under competitive conditions in this country. At the same time, the rate of reduction should be such that it does not unduly disrupt our domestic trade and employment, nor offer difficult administrative problems.

Labor and Special Privilege

The second example of special privilege I want to mention is that accorded to labor. And just as I am not a "free trader," so I am not a "labor baiter." That is as true today as it was before the Management-Labor Conference. But of this I am sure—labor's worst enemy today isn't reactionary employers. It isn't, as many people think, the poor quality of so much of present labor leadership. Labor's worst enemy today is the shroud of special privilege in which it has been wrapped by its misguided and nearsighted friends . . .

As I said a few minutes ago, I am not a "labor baiter." I'll fight with labor against anything that is designed to undermine the basic rights of labor. But special privilege is not the right of any man, or any group of people, in this country. Yet that is what we are up against in the field of labor today—just as a generation or so ago the public was up against special privilege in the field of business. And just as it took legislation to meet the business abuses of those days, so it will take legislation to solve the labor problem of today.

President Truman has made the first move in that direction with his request for statutory authority to appoint fact-finding commissions in disputes of major significance.

Management supported the fact-finding principle in its discussions at the Management-Labor Conference. I hope it also can find its way clear to support the legislation introduced to implement President Truman's recommendation.

Whether it can do so will depend upon the success with which the legislative proposal safeguards against the

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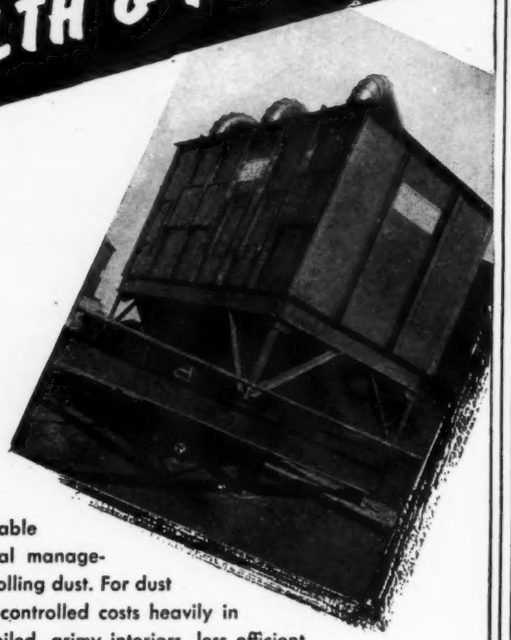

One of the most profitable practices that industrial management can have is controlling dust. For dust *that isn't* scientifically controlled costs heavily in reduced production, soiled, grimy interiors, less efficient lighting, high housekeeping costs, lowered workers' efficiency.

Pangborn engineers, backed by 41 years experience in designing, building and installing the proper dust collecting equipment, have made hundreds of plant surveys of dust conditions in many different types of manufacturing plants. For a soap manufacturer, for instance, where the nature of dust is soap powder, the recommended Pangborn Dust Collecting Equipment has a dust salvage value of $250 a year, assures proper sanitation conditions and reduces plant maintenance costs. For another manufacturer, where the nature of the dust is metallic, the recommended Pangborn Dust Control System saves the company over $8,000 a year.

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following perversions of the fact-finding principle:

1. The fact-finding process should be limited to disputes vitally affecting public health and safety and not to general industry.

2. Fact-finding boards should be appointed "from scratch" for each dispute. We should not establish a single, permanent agency or panel for this purpose. A permanent agency inevitably would establish certain fixed patterns—as did the War Labor Board—which would encourage one party or the other to bypass the basic collective bargaining and conciliation processes in order to get its case as quickly as possible before the fact-finding group.

3. The board should hear all appropriate witnesses presented by either party, but should have no subpoena power to undertake "fishing expeditions" into the confidential affairs and records of the union or the company.

4. The board should be limited to the finding of facts; it should not take sides by issuing recommendations for the settlement of the dispute. Such recommendations would be the normal equivalent of compulsory arbitration.

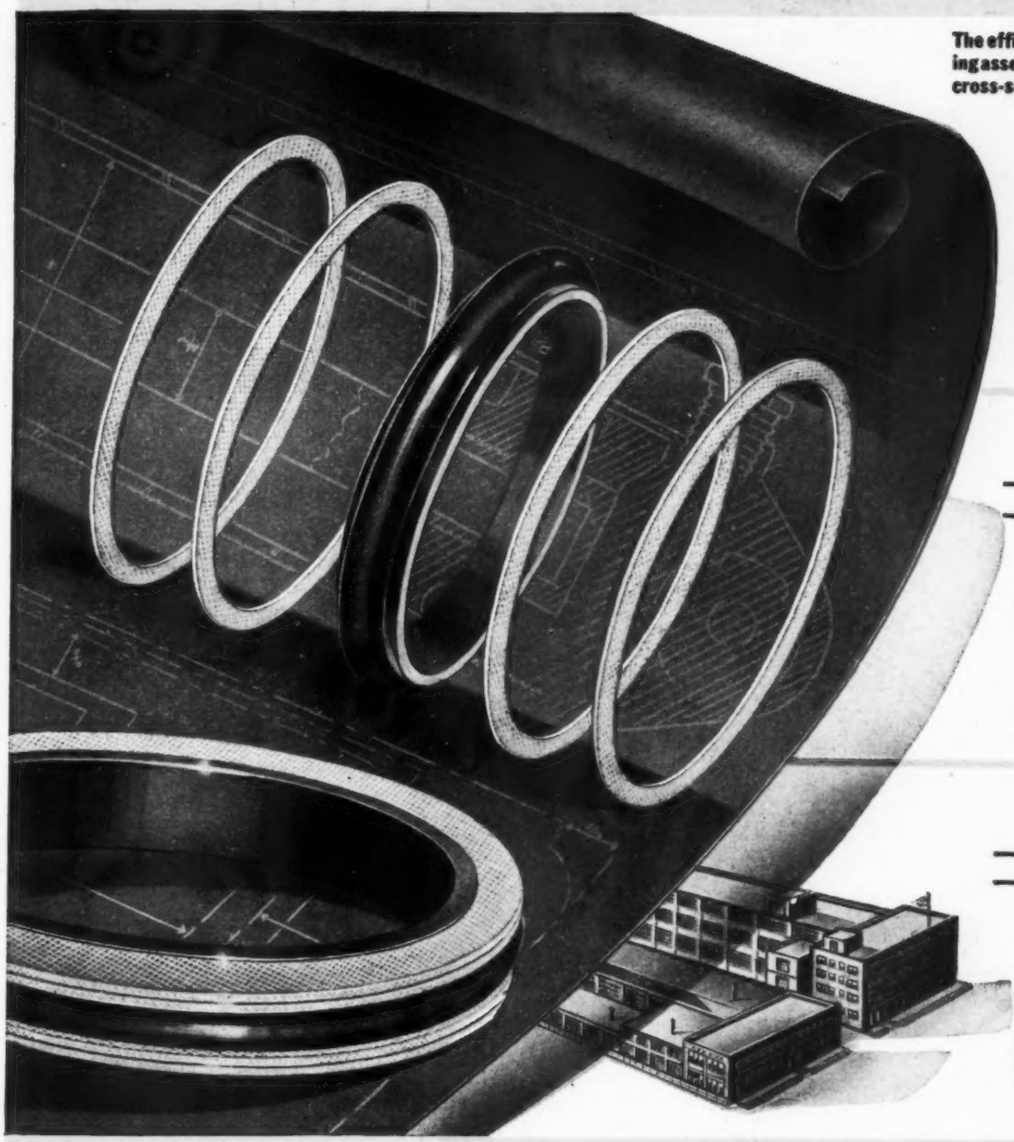
5. There should be strict enforcement of the principle that the *status quo* must be maintained by both parties during the fact-finding procedure. If management should attempt to modify the conditions of employment, or if the union should order or permit a strike, the government itself should have appropriate rights to enforce sanctions to maintain that *status quo*.

We will need still further legislation in the labor field. But at least we have now recognized openly that labor's admitted right to strike is a right which, in common with all other human freedoms, may be qualified and regulated in the public interest.

The third broad line of action which we must follow if we are to enjoy the continuing benefits of full production with full employment *plus* is sound management of our money and credit system, and above all the sound management of our federal debt.

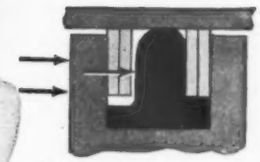
We must have a stable and clearly defined monetary unit. We must have definite limits placed upon the credit expansion powers of our commercial banks. We must make interest rates serve as a guide to the degree of strain to which our financial system is subjected. We must make the banking system serve as a handmaiden of our economic system. We must not permit it to attempt to control the volume

Improved **WEATHERHEAD T-RING PACKING**

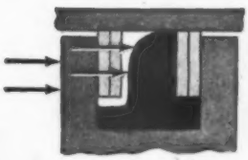


The efficiency of the T-ring Packing assembly is shown by the three cross-sectional panels below.

❶ Packing before pressure is applied. Note clearance between the flanges and the guard rings.



❷ Packing upon immediate application of pressure which swells the flange under the farther guard ring and against cylinder wall.



❸ Full application of pressure. Guard rings are held tightly against cylinder wall — no binding or jamming.

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The problem of properly sealing fluids in many types of machines is an important one. The new, improved Weatherhead T-ring Packing, recently patented, meets the requirements for both standard and special applications. This seal is available in two types and in sizes varying from ½ inch to 4 inch O. D. For information or literature write or phone any Weatherhead branch office.

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There is a size and type to handle *your* job and prove in service that here is sling chain value *plus* by any method of figuring.

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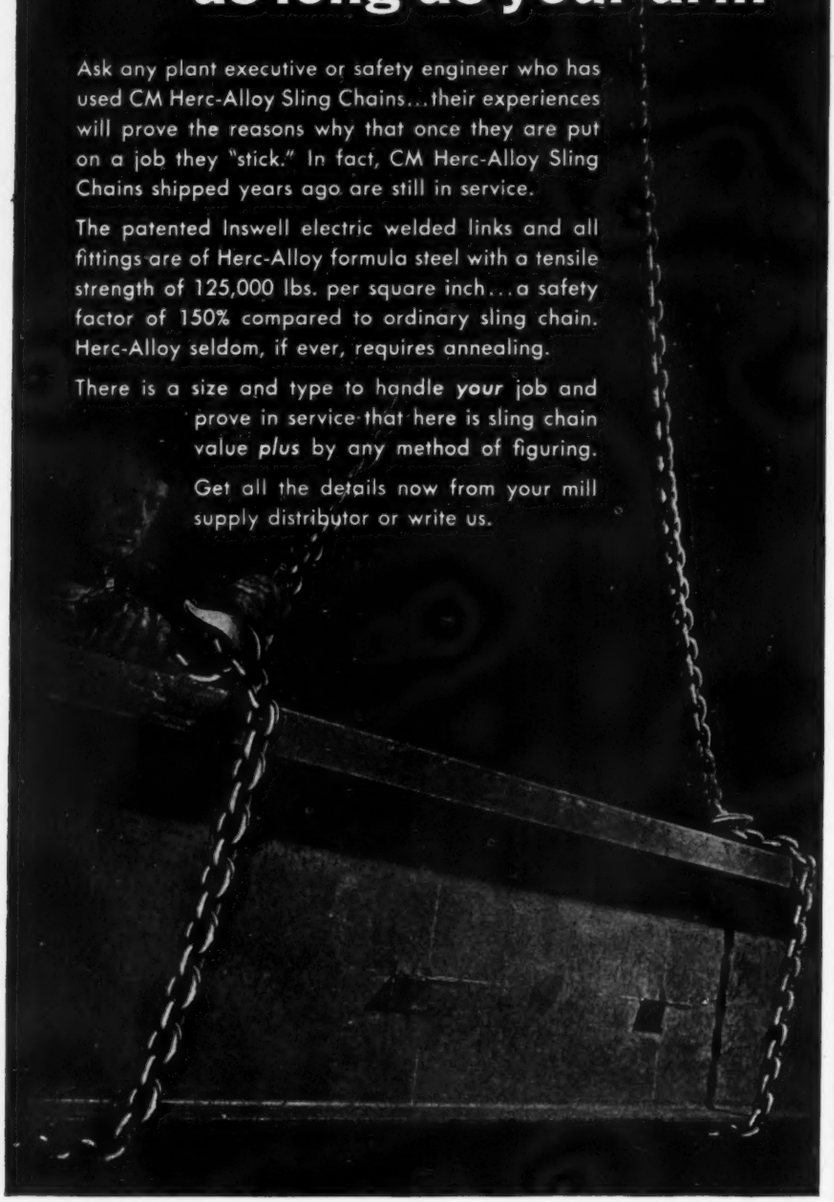

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of business activity. And, finally, we must get the public debt into the hands of those who will hold it as a permanent investment until the bonds are paid off.

* * *

Government's Role in Full Production

HENRY A. WALLACE, Secretary of Commerce

It seems to me that in the broad sense we have a very solid unity in this country as far as our ultimate objective is concerned. Everyone in America—farmer, worker, businessman, consumer—wants our magnificent productive machine to do the best job it can possibly do for the common good. We want prosperity, in other words—a sustained, solid prosperity that is not subject to shattering ups and downs but that stays at the highest possible level over the longest possible periods of time. Call it by any name you like—full employment, full production, or plain, ordinary "good business conditions"—we do have universal agreement that that is what we want.

The only question is, how do we go about getting it? . . .

When we talk about moving ahead toward a higher and more permanent kind of prosperity than we have ever had before, we are talking about a program in which business must take the initiative and bear certain risks. It is up to government to encourage that initiative and to cushion those risks. The Administration's program is based upon that assumption. It wants to make it possible for business to do those things which only business can do. The proposed full employment legislation is fundamentally a declaration of policy and an assumption of responsibility by the federal government that it will assist and not hinder the private enterprise system in operating at a high level of production to bring about adequate employment opportunities and a better standard of living for all.

Toward the same objective, the program of the Department of Commerce within the framework of the general welfare is designed to provide all possible help for business. It is the department's job to promote business; to provide services that business can't provide for itself; to speak for business in government; and to work for a climate of public policy favorable to business expansion. The department's efforts have been and will continue to be devoted to advancing all legitimate competitive business interests.

It is with these general goals in mind that a plan has been developed for strengthening the program of the de-

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POWER PLANTS throughout the industries and institutions that serve America recognize the efficiency of Buell (van Tongeren) Collectors as a protection against fly ash dispersion.

Among the various power plants using Buell Fly Ash Collectors is a leading American educational institution, the University of Illinois at Champaign. The plant of the University has used six Buell Collectors with its stoker-fired boiler, for the elimination of fly ash, over a period of several years.

In fact it may be said that power plants employing Buell Collectors represent a fair cross-section of American industry. They include such well known concerns as: BETHLEHEM STEEL COMPANY, STEELTON, PA., PHILADELPHIA NAVY YARD, WESTVACO CHLORINE PRODUCTS CORPORATION, CONNECTICUT LIGHT AND POWER COMPANY, JACOB RUPPERT BREWERY.

Detailed information on Buell Collectors to meet your specific fly ash requirements will be gladly furnished upon request.

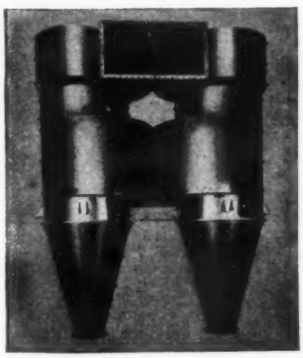

Illustration shows typical unit of a battery of six Buell Fly Ash Collectors installed with stoker fired boiler in power plant of University of Illinois.

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Are your evaporative water coolers and condensers giving below-par performance? Are your operating costs creeping upward? Often unsuspected, though frequently at fault, is the cooler's water supply. By treating recirculating water this newly developed Oakite way you can prevent hard lime scale and slime from interfering with cooler and condenser efficiency.

Simply add to sump water supply tank recommended quantity of Oakite Airefiner No. 52. This scientifically designed chemical agent keeps lime particles in suspension so that they cannot settle on cooler coil surfaces to act as insulation. In addition, Oakite Airfiner No. 52 has potent germicidal and fungistatic properties that discourage the growth of slime and algae in tank, on suction screens, coils and eliminators.

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partment. Under this plan, the department will undertake to provide:

1. Revitalized foreign trade promotion services.

2. Management aids, technological aids, marketing aids, and other forms of direct service for business.

3. Strengthening of the technical bureaus and offices of the department.

4. A strong, balanced program of current and "benchmark" statistics and a complete analytical program to give business and government current information on the economic situation and business outlook . . .

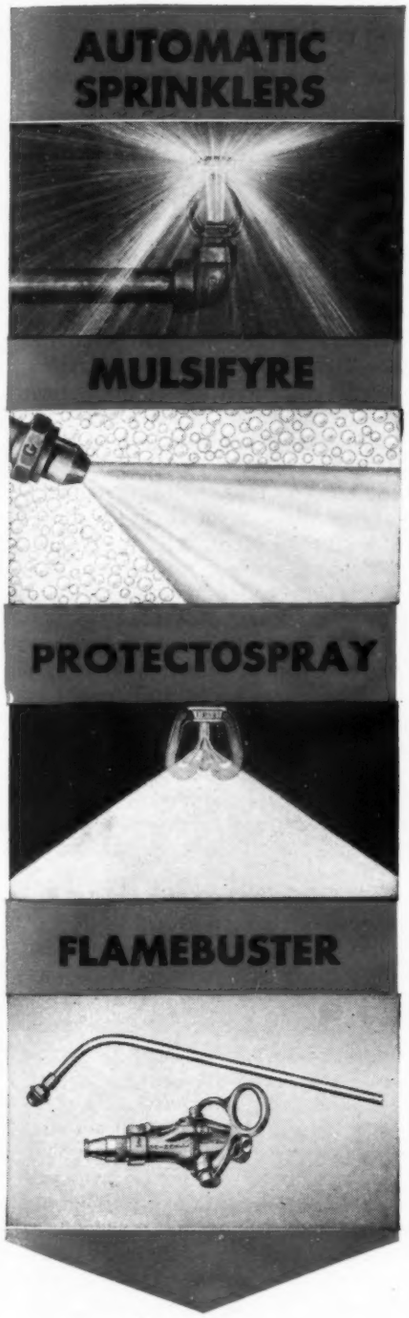
Public services performed by government will be on a broader scale than in the pre-war period, but that in itself will not bring the kind of increase in the standard of living that is possible. The job is one which must be done primarily by industry and labor. Satisfactory profits for stable enterprises and higher rewards for venture capital in new undertakings are essential. At the same time, real purchasing power in the hands of consumers of all classes must be adequate to sustain the new rate of production. This can come about through increased money earnings, lower prices, or improved quality of product. Probably all three factors should be present in some degree, but with varying emphasis in particular industries according to circumstances . . .

The salvation of American industry —and of the American economy and our free enterprise system itself—lies in a process which is perfectly familiar to all of you—technological improvement, greater productivity, expanded production, expanded consumption, and increased profits based on high volume rather than high prices. We must find the golden mean in distribution which will assure adequate return to capital, to provide both the incentive and the means for profitable investment, while simultaneously providing consumers with mass purchasing power to absorb high levels of production. . .

The key to the problem of sustained high levels of production, employment, and sales may well be the key to the preservation of our free enterprise system and our economic liberties as we know them. Our free enterprise system, which has produced a higher standard of living for the American people than any ever achieved by any people through any other system, must be preserved. I am convinced that it can be preserved. But it will require the cooperation of all elements of our economy and a high order of statesmanship on the part of business, labor, and government leaders. We cannot afford to

FIRE PROTECTION

Engineered to Meet All Hazards

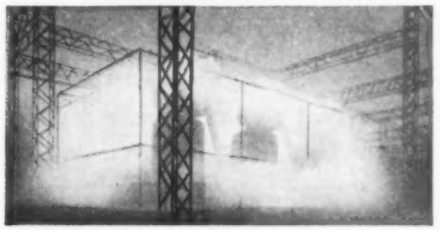


FOR ORDINARY RISKS . . . . ON GUARD 24 HOURS A DAY

Grinnell Automatic Sprinkler Systems protect over 70 billion dollars' worth of property. When fire occurs, heat causes the sprinkler head above it to open at a predetermined temperature and release a deluge of water on the fire.

FOR OIL FIRES . . . . . PROTECTS 20,000,000 KVA TRANSFORMER CAPACITY

Grinnell Mulsifyre Systems extinguish fires in heavy and medium oils and flammable liquids. A permanent piping system, widely used to protect transformers, oil lines, quench tanks and bilges of oil-burning ships.



FOR PROTECTION BY COOLING . . . . SAFEGUARDS TANKS OF EXPLOSIVE MIXTURES

Grinnell ProtectoSpray System protects tanks, structures and equipment by insulation and cooling against serious distortion or buckling even when exposed to the fiercest flames from a volatile liquid fire.

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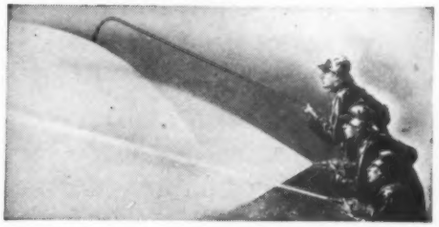
Grinnell FlameBuster is a three-purpose portable hoze nozzle. Low velocity spray, from 4' to 10' applicator, for stubborn fires in light, flammable liquids; high velocity spray for fires in heavier oils; and solid stream for mopping up operations.



For complete information on any of these systems, write Grinnell Co., Inc., Executive Offices, Providence 1, R. I. Branch offices in principal cities.

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FOR 101 METAL CUTTING JOBS . . .

Versatile

Here, in the Wells No. 8, is one of the most useful and versatile machines you can have in your shop. You will use your Wells for all types of cut-off work around the plant—in the stock and tool rooms and for maintenance.

It efficiently cuts bar stock, angles, square or round tubing—all types of metals. For production work, your Wells can be equipped with the new Wells Wet Cutting System for faster cutting and blade saving. Because it's portable, you can save time and labor by moving the saw to the work.

The gravity-feed and automatic shut-off make it possible for one man to operate two or more Wells saws simultaneously. Why not write today for full information?

Specifications

CAPACITY: Rectangular	8" x 16"
(Special Guides)	5" x 24"
ROUNDS:	8" Diameter
MOTOR:	½ H.P., A.C. or D.C.
SPEEDS:	Selective 60, 90, 130 feet per minute
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sell the American system of free enterprise short with shortsighted policies and actions based on short-run considerations.

•

Britain's New Census of Production

From McGraw-Hill News Bureau, London

Britain is to have an all-inclusive annual census of production to replace the obsolete census which has been taken since 1906 at 5-year intervals.

In the past, statistics have been collected on such matters as volume of production, number of establishments, regional distribution, employment, total wage bills, mechanical power, and consumption of fuel, but the government completely lacked information now regarded as essential to the maintenance of full employment and the modernization of British industry.

The new plan was initiated last June with the appointment by the coalition government of a special committee to study the problem, and the committee's report, just published, now has the full backing of Sir Stafford Cripps, president of the Board of Trade.

Chief innovation recommended is the collection of complete statistics relating to capital assets. In line with one of the basic conclusions of the Coalition White Paper on Employment Policy—that sanctions in expenditure on capital development are a prime cause of general business fluctuation—the committee considers it vitally important that statistics should be compiled regularly on fixed assets, stocks, and work-in-progress.

It is believed that these basic facts can be used as a yardstick with which to compare each year's new additions to capital equipment. So far as possible the values given are to be those filed for income tax purposes.

It is also recommended that certain industries report information about the number, types, and capacity of the principal machines and plants installed—for example, the number of spindles or looms in the cotton industry.

Statistics relating to the value of fixed capital assets are expected to provide further aid in determining the progress of various industries in capital re-equipment and extension.

It is suggested, moreover, that information on the total floor area of factory buildings could be used, in conjunction with the number of persons employed, as a common quantitative denominator in reaching decisions about location of industry problems. At

Customers are factory-built too!

How will the customers be created whose money will be needed to keep your plant going at profitable levels?

Not by selling and advertising alone — nor by new gadgets or finer appearance or promises of better performance.

If wages and distribution costs are to remain high, the only way you can keep prices low enough to create new customers (without affecting profits) is to increase production . . . lowering costs, attracting greater quantity and frequency of buying, making new jobs, giving business an adequate return on investment.

The Bullard Company, Bridgeport 2, Connecticut.

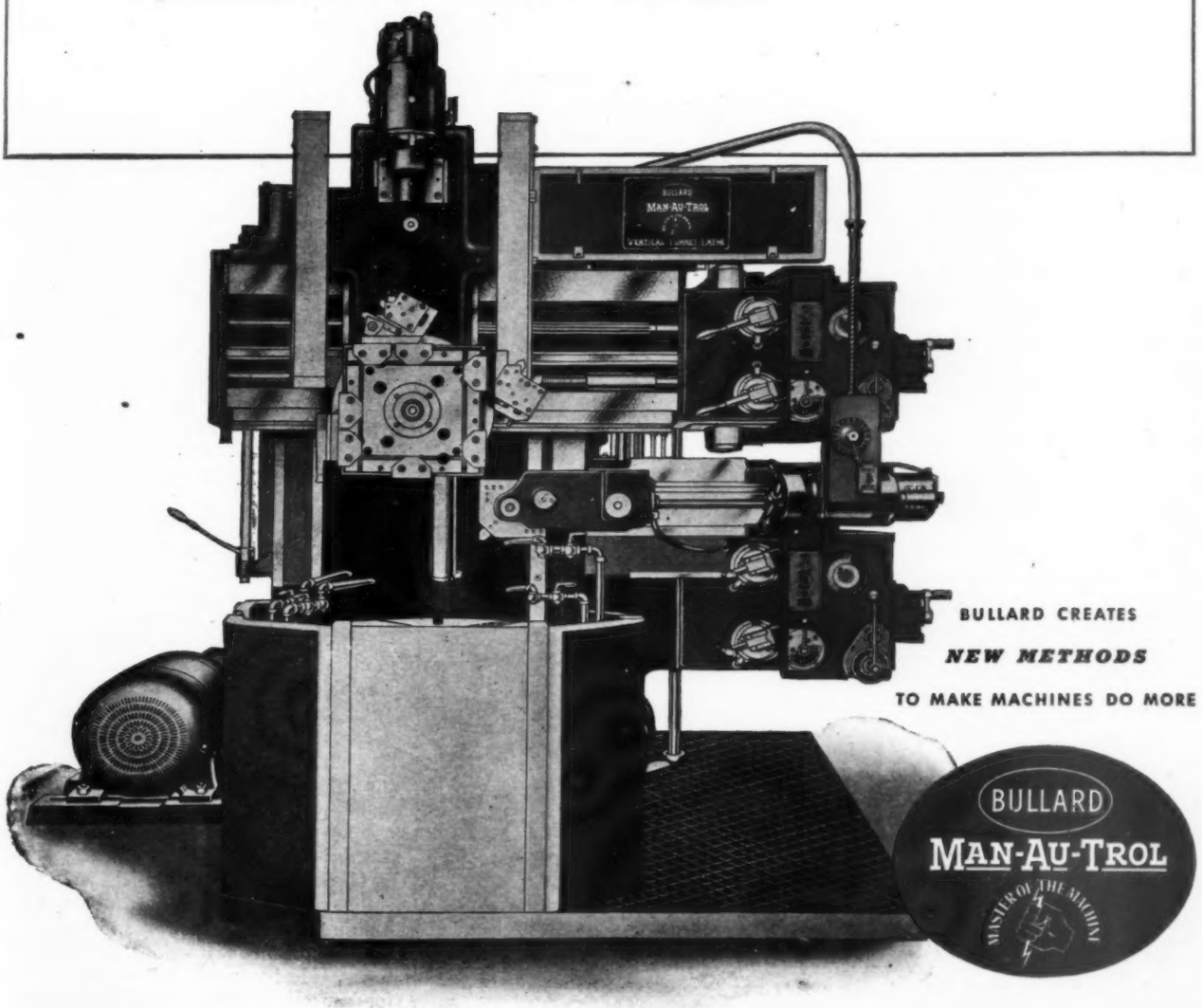
for example: SEE HOW THE BULLARD MAN-AU-TROL VERTICAL TURRET LATHE LOWERS UNIT PRODUCTION COSTS

LIGHTENS LABOR'S LOAD — Operator machines one piece manually, setting production method into automatic cycle; then merely loads, supervises and unloads while MAN-AU-TROL does the work.

MAKES AUTOMATICITY VERSATILE — Automatically handles any work within manually-operated scope of Vertical Turret Lathe. Converts instantly to manual operation on same or entirely different piece without affecting automatic cycle.

SAVES SET-UP TIME — Set-up time from one class of work to another is only slightly more than for a manually-operated machine.

REDUCES SALVAGE COST — Machines day after day with consistent accuracy not obtained under manual operation.



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NEW METHODS
TO MAKE MACHINES DO MORE

BULLARD
MAN-AU-TROL
MASTER OF THE MACHINE

Industrial plants, warehouses, docks, transformers, oil quench tanks—no two are alike, hence no two should be treated alike in the matter of fire protection.

"Automatic's" job for many, many years has been to design, manufacture and install fire protection systems. We know that what is adequate in one instance may not be suitable in another. Fire protection in a cold storage plant, for example, would be wholly inadequate for a powder manufacturer.

Right there is where the knowledge and skill of "Automatic's" engineers is of inestimable value. Drawing from a wealth of experience, they recommend only that fire protection system which is *best-by-test for any given purpose or condition.*

Today's executives, entering upon an era of peace-time effort, know the wisdom of safeguarding lives and property . . . which explains why so many are writing "Automatic" for detailed information on fire protection. Why don't you?

—a famous member of the "Automatic" Sprinkler Family. Provides adequate protection for quench tank, transformer, oil line and other fires of flammable liquid origin.

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

the same time, facts on the age of buildings are to be used in town planning and urban redevelopment schemes.

A second major innovation is the collection of particulars of wages, salaries, depreciation, rent, rates, and taxes (other than taxes on profits)—in short, the principal items of costs. Up to the present it has only been possible for the Board of Trade to use the census of production to gather information on the cost of materials and the amount paid for work contracted out.

Other items to be covered in the new census include man-hours worked; the extent of control by foreign as well as other British business interests; and statistics relating to the different categories of manufacturers' sales.

Sir Stafford Cripps is throwing his weight behind these recommendations and, in view of the eminent businessmen on the committee, he fully expects the report to be accepted by British industry. But since it will not be possible to introduce legislation until next year, a full census of production on the new basis can hardly be taken before 1947.

Meanwhile, arrangements are being made to take a partial census for 1946 covering a limited number of industries. The provisional list includes mechanical engineering, electrical engineering, hardware and sheet metal, tool and implement, chemicals, dyestuffs, and drugs, clothing, and building and contracting.

This development is an example of close teamwork between business and government. It indicates that the British are taking seriously the job of industrial regeneration.

Broader Fields for Engineers in Industry

(Excerpts from a speech by J. P. Kottcamp, Vice-President, Johns-Manville Products Corporation, before the American Society of Mechanical Engineers, are followed by portions of talks by other speakers at the same meeting.)

Problems of winning the peace will be no easier than the problems of winning the war. Here again the engineer will be called upon to make his contribution. How great a contribution he will make will depend entirely upon the opportunities afforded him and the opportunities he creates for himself.

The common picture of the engineer is that of a man poring over a blueprint, building a gigantic dam or super-generator, examining a fractional distillation tower. He has made such a reputation for himself in these activities that little

YOU CAN CUT YOUR TOOL COSTS

•

SAVE TOOLS

and TIME . . . When You Clear Quitting Workers

It runs up your tool costs to lose a tool or two for every employee who leaves you. Your losses average at least that much unless you have a tool crib system that can't be beaten.

Let us tell you how and why in the words of a seasoned general superintendent who knows what goes on at the tool crib:

"Under the old system, a worker receiving a tool presents a numbered check which is hung on a hook in place of the tool. In theory, here is a complete record of accountability. In practice, several unexpected things may happen.

"The man may quit and the chances are strongly against being able to find his checks, scattered as they are among hundreds of shelves, drawers and other places. No simple record is furnished of the tools charged to one man and in consequence there is no possibility of a conclusive clearance of his accountability. It is always possible for employees in some way to avoid responsibility for lost, broken or stolen tools.

"We now know (thru McCaskey Tool Control) exactly what tools each employee has and when he got them. In case an employee leaves or must be laid off, he must account for the tools he has borrowed. We can instantly issue his clearance by referring to the tool order tickets filed under his clock number.

"There are no arguments because he has signed for every tool. . . . The new plan has reduced disputes and losses . . . has more than saved its cost."

You can investigate the many cost reducing elements of McCaskey Tool Crib Control in a few minutes. And what responsible executive can overlook any possibility of cutting costs for the period directly ahead?

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There are a "thousand-and-one" industrial uses for

HEIN-WERNER
HYDRAULIC JACKS

GREAT for lifting heavy loads • moving machinery • pressing bushings, etc.

The average factory can find many uses for a Hein-Werner Hydraulic Jack—prompting many to call it the *"jack of all trades."*

Made in models of 3, 5, 8, 12, 20, 30 and 50 tons capacity, these jacks are great time and labor savers. They are sturdy, compact, super-powerful, easy-operating, and absolutely dependable.

For details, consult nearest industrial supply distributor, or write us.

HEIN-WERNER MOTOR PARTS CORP.
WAUKESHA, WISCONSIN

thought is ever given to the wider uses for his training, his analytical mind, and his capabilities.

For the most part these talents have been confined to the purely material side of mechanics, steam, electricity, physics, chemistry, and related fields. But engineering is more than that. Despite the emphasis placed on the material side of engineering let us recall its age-old definition. It is described as:

"The art of organization and directing men, and of controlling the forces and materials of Nature, for the benefit of the human race.

"Three elements are involved. One deals with men, the second with forces and material, the last is the ultimate purpose."

The engineer has yet to come into his own to embrace all of these aims of his profession and to assume the responsibilities which should be his by virtue of his background. Given the opportunity, more engineers can be of greater assistance to top management.

If allowed a broader approach the engineer could utilize his peculiar talents to the fullest. Specifically he could be of invaluable assistance to top management in the field of research.

Prospectors For Knowledge

Now what do we mean by research? It is not the limited meaning usually given it when applied to a research laboratory or a division of a company. As C. F. Kettering, head of the research department of General Motors says:

"For some reason, that word 'research' has come to be surrounded by a good deal of meaningless mystery. If I can accomplish nothing else, I should like to dispel some of that mystery. Research, after all, is nothing but prospecting for knowledge. Whenever someone sets out on an organized program to uncover new knowledge about a subject of which he knows very little, he is engaging in research. There is nothing mysterious about it, nothing highbrow. It is the most natural thing in the world. One of the great troubles with research as it is usually carried out today is that it is too impatient to get tangible results. What we need is more analysis of fundamentals and less invention for invention's sake."

That is where the trained engineer enters the picture. He is at heart a prospector for knowledge. Because of his training he is guided by sheer logic and may be counted upon to gather, evaluate, and collate the thousands of facts that enter the industrial picture and present them to top management for decisions of policy.

That is a responsibility of management, to broaden the field of research

Quick-As-Wink

• HUNT CONTROL VALVES •

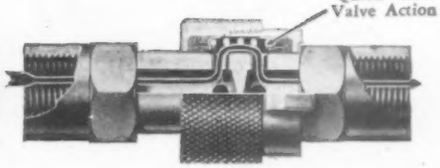

Illustration of the Quick - As - Wink Valve Action

★ USED ON AUTOMOTIVE EQUIPMENT ★

Both of these machines are products of The Akron Standard Mold Company, Akron, Ohio. *(Above)* Universal Undercut and Tread Stitcher. *(Below)* Steering Wheel Press.

Hunt engineers co-operated with the customer's engineers in designing a special valve for this Universal Bead and Tread Stitcher. A Quick-As-Wink 2 pressure, 3-way, air valve does three things with one control . . . exhausts air, exerts low pressure, and then extreme high pressure.

★

This Steering Wheel Press is equipped with four Quick-As-Wink valves . . . two diaphragm valves (No. 4500) and two Air Valves (No. 700). The Quick-As-Wink pilot control assures positive, foolproof continuous low-cost production.

★

Quick-As-Wink Valves eliminate power waste. Their U-Shaped packers are pressure sealed against internal leakage. Made of high quality metals throughout, *ALL* Quick-As-Wink Valves have buffed and polished stainless steel bodies and plungers.

★

Write for your copy of the easy-to-use, factual Quick-As-Wink valve catalog.

C-B-HUNT & SON, inc.

SALEM - OHIO

INLAND 4-WAY FLOOR PLATE

You get greater safety, structural strength, and long life when you install Inland 4-Way Floor Plate.

Its special 4-way pattern helps prevent slipping and falling by men, and skidding by trucks. It has all the structural strength and long wearing qualities of rolled steel. It naturally will not rot, splinter, warp, or absorb moisture or odors. And, it is easily cleaned.

Write for Bulletin

INLAND STEEL CO.

38 S. Dearborn St., Chicago 3, Ill.

Sales Offices: Cincinnati • Detroit • Kansas City • Milwaukee
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to embrace every phase of its activity. In the complete industrial society under which we now live, management no longer represents as formerly a single interest. Increasingly it functions on the basis of a trusteeship, endeavoring to maintain a proper balance of equity between four basic interlocking groups. These are the stockholders, the jobholders, the customers, and the public.

It has been only recent years that the interdependence of these different social groups has been recognized. But this interdependence is far from being understood. Yet the mutual obligations of these groups must be clearly perceived if society is to progress.

To maintain a proper balance between the various groups directly and indirectly concerned with its operations, top management must tackle more of its problems more scientifically.

Two Problem Groups

These problems may be divided into two basic groups. As Claude Robinson of the Opinion Research Corporation has pointed out, they are *economic products* and *social forms*.

On the product side we invent, manufacture, advertise, sell, and distribute. On the institutional side we also invent or manufacture organizational devices, advertise them, tell our people of their advantages.

Social forms, as defined by Robinson, are simply relationships between people that recur and form observable patterns. They are the relationships that constitute the organization of economic society.

Incentive discounts for dealers, the 8 hour day and 40-hour week, loan systems for tiding workers over slack periods are all examples of the manufacture and distribution of social forms.

Other examples include more leisure for all, a decent living for all, the annual wage, hospitalization, higher wages, unemployment insurance, pleasant working conditions. Note how all these items bear upon human relations.

Explaining that business has always prospered under competition, Robinson goes on to say that the steps for the solution of the competitive problem in the area of social forms are exactly the same as they are in the area of product competition.

The economic product competes with products of other manufacturers, cooperatives, and government plants. . .

You are all very familiar with product competition. But I think it would be worth while to examine more closely some of the competitive aspects of social forms.

During the past 15 years this field has been exploited by the social planners to

WM-1

Husky *enough* to do a clean, quick job of sanding, polishing, and finishing...

Portable *enough* to be used just where you want it . . .

Delta

MILWAUKEE

REG. U.S. PAT. OFF.

6" Abrasive Belt Finishing Machine

Reduces your cost per unit for sizing jobs on many types of materials — polishing and sizing metal parts . . . finishing and polishing die castings . . . finishing, finning, and surfacing plastic parts . . . edging and burring small parts...other small finishing operations.

This Delta-Milwaukee Abrasive Belt Finishing Machine is a versatile unit. It can be used horizontally, with adjustable fence for edge sanding and with adjustable back stop for face sanding. Or it can be used vertically with 7" x 15" tilting table.

Built for Dependability

Famous Delta construction features include: Lubricated-for-life, double-sealed ball bearings. Completely enclosed housing, complying with safety requirements. Exceptionally heavy main drive shaft, with large diameter drum (5½"). No rubber covering required on drums, thus eliminating replacement expense. Adjustable deflector on drum hood, to catch dust. Suction spout on hood. Other features that help this machine perform dependably in continuous high-production service. Efficient dust collector also available.

To enjoy creditable results on your finishing operations, install a Delta-Milwaukee Abrasive Belt Finishing Machine. See your Delta distributor. And send coupon below for free catalog of low-cost Delta-Milwaukee Machine Tools it pays you to know about.

Finishing machine in horizontal position (with fence)

SPECIFICATIONS . . .

Dimensions:

Tilting table.....7" x 15"
Mitre gage groove.....⅜" x ¾"
Cloth-back belt.....6" wide x 48 $\frac{5}{16}$" long

Overall dimensions:

28" long, 18" wide, 36" high in horizontal position, 54" high in vertical position.

Shipped complete with Aluminous Oxide belt, tilting table, cast iron stand with belt guard, V-belt and motor pulley. Without motor or switch. Shipping weight, 205 lbs.

[Tear out coupon and mail today!]

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Please send me, without obligation, the latest catalog describing low-cost Delta-Milwaukee Machine Tools.

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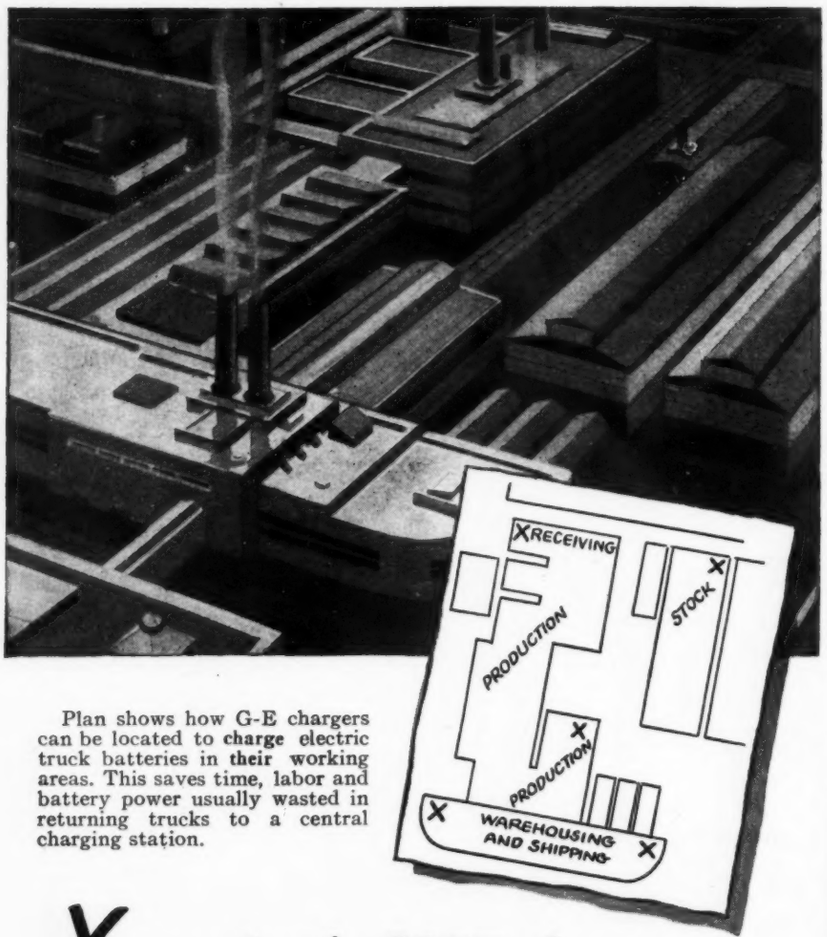
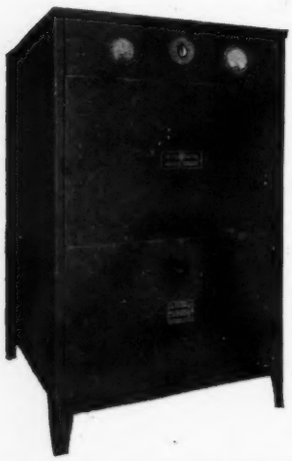


Plan shows how G-E chargers can be located to charge electric truck batteries in their working areas. This saves time, labor and battery power usually wasted in returning trucks to a central charging station.

X marks the SPOT for a G-E BATTERY CHARGER

Gone are the days when it was necessary to ship electric trucks to a central charging station after long hauls or a hard day's work. Now you can charge batteries in truck working areas by simply "spotting" G-E Copper-oxide battery chargers at strategic locations where they are always ready to do a job. The savings in time, labor and battery power are obvious.



The charger is easy and economical to use. It's fully automatic so—all a user has to do is plug in the connections, turn on the switch and the charger does everything else. It shuts off automatically on completion of the charge and a built-in control prevents batteries from discharging back through the charger after the a-c current turns off.

There are G-E Copper-oxide chargers for lead-acid batteries, nickel alkaline batteries or combination chargers to accommodate both. G-E chargers have no moving parts other than the cooling fan hence, maintenance costs compared with other types of battery charging equipment are negligible. For full details write: Section A267-37 Appliance and Merchandise Dept., General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

a greater degree than at any time in our history. The planners have used every method at their command to further government control of industry, with the ultimate aim of setting up some form of state socialism. It is not for me to question their motives. Admittedly some of them may be selfish. Some may be idealists in quest of the illusory pot of gold at the end of the rainbow. But there are among the social planners those who sincerely believe that our system of free enterprise has failed and that if mankind is to benefit there must be a change. They have used social forms to set up competition between government and industry.

These social planners and their schemes cannot be dismissed with a categorical denial. Rather it is up to industry to prove that it can do a better job without governmental intervention.

Some union leaders have adopted the scientific approach to the social forms which they are advocating. Recognizing the truism that there is no substitute for cold facts upon which to base a course of action they have marshaled the best of talent in many fields to keep them informed. They have developed a habit of scientific thinking which has aided them on numerous occasions to present their case thoroughly and with great success.

Industry, too, must develop this habit of scientific thinking in the field of social forms. There is a crying need for it. Economic and social pressure is demanding it.

Social Science Research

Years ago there were no such economic and social demands on top management. Accordingly it endeavored to do its own research, if it did any, in this field. But now as a result of the growth of labor unions, the vastly changed social outlook, and the increasing activity of competition, top management sorely needs this type of scientific approach to its problems.

We might well ask ourselves if this change in public sentiment has been caused by smart propaganda on the part of labor leaders, poor judgment on the part of management for not having done a better public relations job, or if it is merely a symptom of the changed social outlook. The research engineer can be of tremendous help in assembling data that would answer these questions. There is a crying need for scientific investigation of the conditions surrounding manufacturing plants, with particular reference to the attitude of the community toward the local industry or company.

This habit of scientific thinking is equally applicable to both large and

NEW COOLANT FILTER SAVES MONEY 7 WAYS

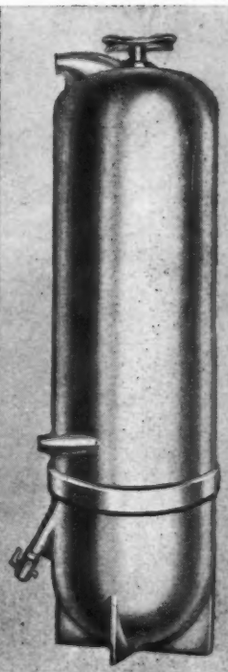
while protecting finishes

You save money first because Cuno's new COOLANT-KLEAN is *priced* lower than most filters. Fewer man-hours of maintenance are needed because the filter element stays clean longer—up to six weeks . . . helping to produce scratch-free finishes. When the element does need replacing, it's a quick job—under 5 minutes. You also save on the cost of elements because each one is priced less . . . and fewer replacements are needed. Grinder coolant stays clean much longer, so that saves money, too. And, seventh, wheel life is greatly extended, so you pay less for wheel replacements.

COOLANT-KLEAN handles full flow of coolant or cutting oil, removing all abrasive and metallic particles which would cause surface imperfections, yet it requires less floor space than other more expensive types. No filter aid needed. No pre-coating. No nuisance of "stuffed type" element. Applicable to individual machine or central system.

Describes "Finer Finishes at Less Cost"

This newest advance in coolant-cleaning is described in Bulletin 3110. Send coupon now for your copy. Find out how simple it now is to obtain finer finishes at less cost.



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Please have representative call ☐

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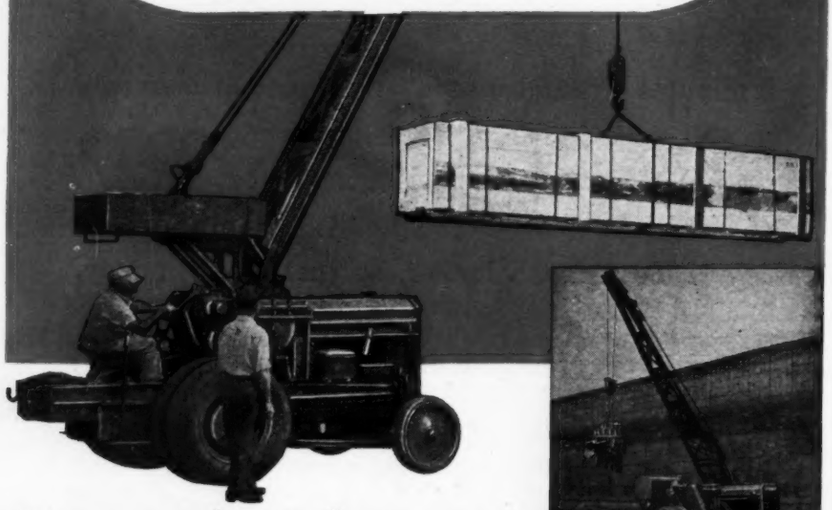
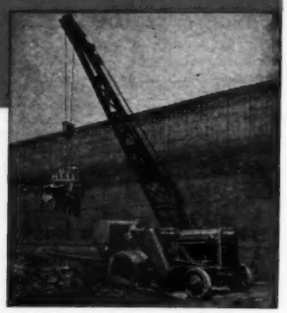
Big Stuff Off and On Trucks, Freight Cars • Moving Large Machines and Parts • Handling Bales, Boxes, Drums • Moving Big Castings, Motors, Railroad and Marine Gear • Loading Air Transport Planes Handling Tanks, Pipe, Structural Steel, Rails, Timber Installing Heavy Valves, Fittings . . . and lots more!





• You can equip your Roustabout with magnet for efficient handling of scrap, ingots, castings, etc.

Gives you faster, lower-cost action on 100 Load-Handling Jobs . . . all over your place

Roustabout users in hundreds of different industries have found this modern load-hustler far more useful than they expected. For it goes everywhere — up, down, in and out — keeps things moving, prevents delays, meets emergencies without taking crews from other work. It handles any load to 7½ tons, is built for years of overwork — all gears run in oil, ball-bearing boom turntable, full-swing boom, smart operation. Your Roustabout Crane quickly pays for itself by faster load-handling and lower-costs. Full facts without obligation — write today!

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ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

small companies. In the struggle for survival a company cannot operate on opinion and whim. We are living in a scientific age and must use the scientific approach in every possible field.

By adopting the scientific approach, through engineering research, top management should be able to solve the problems both of products and social forms and coordinate the diverse phases of a modern corporation for the greatest good of the greatest number.

Departments Interdependent

The complex departments of a large corporation—sales, production, finance, research, industrial and public relations, engineering—cannot be independent, each reporting separately to one superior. All are dealing in one way or another with products and social forms. Each is dependent on the others. And all have a direct bearing on the stockholder, the jobholder, the customer, and the public.

Top management is responsible for seeing that all departments are coordinated in carrying out current operations as well as in contributing to the long-range planning which is so vital to the life of any business.

To accomplish all this requires a well-knit organization in which everyone knows what is expected of him and does it, and in which overlapping of functions is minimized, duplication of effort eliminated, and specific responsibilities for specific jobs are clearly designated.

The formation of such an ideal organization requires the analytical mind, the type of mind that the experienced engineer possesses.

Engineer Fact Finding

I see no reason why it is not possible to use an engineering approach to an entire organization. An objective, fact-finding research organization to evaluate all of the many activities of a corporation should be of great assistance to top management in making decisions.

To be successful such an organization, or such an individual in a smaller company, should be on a par with the major divisions of a company and report directly to the president. It should have its fingers on the pulse of the company at all times. Too often many a good idea has been rejected by top management because its method of presentation has been slipshod, weak, carelessly thought up, or too cluttered with non-essentials that obscure the crux of the problem. Then again, much time, labor, and thought are devoted to the study of a problem which bears only an insignificant relationship to the full operations of the company. A proper research department would have the ad-

"You save the cost of the hole..."

This hydraulic cylinder *could* be hogged out of bar stock, but tubing does the job with less waste, at less cost—because the "hole" is there to start with. This basic advantage of steel tubing is obvious enough to be often overlooked.

Thousands of mechanical parts are made faster, easier and cheaper with steel tubing —and tubing is just as easy to get as to use. In carbon mechanical grades alone, Frasse stocks a size range from 3/32" to 10" O.D.... for immediate shipment...in a wide variety of convenient wall thicknesses.

If you use alloy or stainless tubing, Frasse has it just as handy. Frasse stainless inventories include types 304, 316 and 347 in broad size ranges, and alloy stocks include NE 8630 and AISI 4130. Pipe sizes, too, are immediately available in both stainless and carbon grades.

Frasse has long specialized in the distribution and development of steel tubing. Backed by over 45 years experience in tubing and its uses, Frasse counsel is freely available on your production or procurement problems. Call us.

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MECHANICAL STEELS AND TUBING

Stainless, Alloy and Cold Finished Carbon Steels
Bars · Sheets · Tubes · Strip · Wire

for the first time . . .

The Cleanable
Electro-CELL

Sectional-type Electronic air filter with removable collector plate assemblies. This feature eliminates need for providing water, oil, compressed air and sewer connections at each installation. Spare collector plate assemblies can be set into place and service continued uninterrupted while dirty plates are being cleaned. Send for Bulletin No. 252.

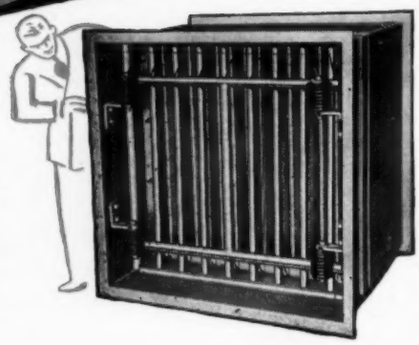
Self-Cleaning
Electro-MATIC

The completely automatic operation of this Electronic filter answers both the problem of removing the dust and smoke from the air, as well as the secondary problem of disposing of collected material. A continuous curtain of collector plates passes intermittently down the front of the filter and thru a viscous cleaning bath at the bottom. Send for Bulletin No. 250.

a complete line of Electronic air filters

Renewable Media
Electro-AIRMAT

This is the only Electronic dry filter on the market. Uses sheets of "charged" airmat paper which are renewed manually or by a mechanical loader. Combines mechanical filtration with Electronic cleaning providing continuous service even thru a period of power failure should it occur. Send for Bulletin No. 253.



● AAF offers, for the first time, high efficiency air cleaning in three types of Electronic filters to meet any requirement, either commercial or industrial, for *super-clean* air. For the interesting story behind the development of these filters which are the result of 10 years of research and experimentation, send for the helpful booklet "The Magic of Electronics in Air Filtration."

AAF
AMERICAN AIR FILTER COMPANY, INC.
Incorporated
Electronic AIR FILTERS
FOR EVERY COMMERCIAL AND INDUSTRIAL AIR CLEANING PROBLEM

vantage of being acquainted with the basic problems of the company and would be able to sift the wheat from the chaff and submit the significant facts to top management. Moreover, top management would be receptive to such a thoughtful, logical, and carefully prepared presentation.

Engineering Human Relations

From what I have said about the cold, calculating, and analytical nature of the engineer it might seem that he would be quite out of place in any field where the human equation is so important. Happily the reverse is true. Just as the engineer studies the mysteries of electronics, the phenomena of the atom, and the possibilities of jet propulsion, so can he view the human equation as another problem in variables that must be analyzed. Perhaps engineering research may be in a position to solve some of the rather vexing and complicated problems of the day.

One of our biggest problems is to find a common ground for labor and management. Name-calling will serve no purpose. When all is said and done, labor is interested in being assured of a decent living and job security. Management must make a profit to continue to remain in business and reimburse stockholders who have invested in a company. And the consumer wants quality goods at low prices.

Would a broadening of the scientific approach to management help to solve this problem? It seems likely that it would. . .

From what I have said it may appear that I have envisioned the engineer who is handling research for top management as omniscient and omnipotent. I have not meant to create that impression. In the final analysis this engineering research this prospecting for knowledge is nobody's monopoly. It is not necessarily true that because a man has obtained an engineering degree, he has an engineering turn of mind. There are many men with analytical minds who have had no formal engineering education. But the schooled engineer has this advantage—he is thoroughly grounded in fundamentals and principles and has the ability to obtain and compare facts with these principles. As a result of this background he is in a position to present recommendations based solely on facts and not merely on opinion. . .

Challenge to Engineers

Research engineers, as well as top management, should be men of ability and vision. Without these traits they would bog down of their own inertia. They would become set in their ways

Above map does not attempt to show all products available in the various states

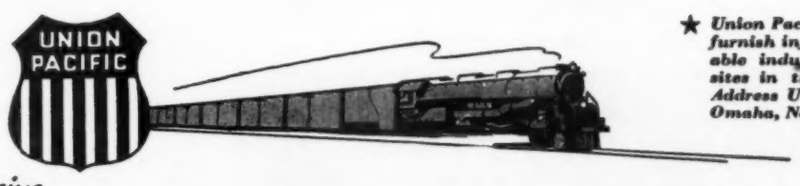
For more than 75 years, Union Pacific has served thirteen western states . . . been a partner in their development.

This vast fertile territory is more than the breadbasket of the nation. Due to its great wealth of industrial raw materials—ore, minerals, petroleum and lumber—it might also be called the nation's treasure-chest. Rivers have been harnessed—providing irrigation and power. And there is splendid rail transportation.

These thirteen western states served by the railroad are ripe for postwar expansion. They have the materials, facilities and space.

Union Pacific will continue to play its part in the future progress of this western territory by providing unexcelled freight and passenger transportation over its Strategic Middle Route.

Be Specific— say "Union Pacific"



★ *Union Pacific will, upon request, furnish information about available industrial and mercantile sites in the territory it serves. Address Union Pacific Railroad, Omaha, Nebraska.*

The Progressive

UNION PACIFIC RAILROAD

The Strategic Middle Route

● Goergen-Mackwirth engineers have designed exhaust systems for disposing of all of the objectable by-products mentioned above as well as for many other material handling and dust removal problems.

One of our customers had a dust problem in his shaker-screening and mixing operation. A very fine dust made it necessary for employees to use respirators continually and caused considerable discomfort. A Goergen-Mackwirth collecting system was installed which removed the dust and allowed the men to work in comfort without respirators. The dust was collected in the special rarified dust collector shown above and the air discharged to the atmosphere.

Let us survey YOUR problem. We will submit recommendations, design the complete system, prepare drawings for submission to the State Department of Labor for approval, and install the system in accordance with the Labor Department's rulings. Write or phone for one of our engineers to call.

Goergen-Mackwirth
COMPANY, INC.
817 SYCAMORE STREET, BUFFALO 12, N. Y., Phone: CLeveland 6661

and would son be far behind in the competitive race.

The man of vision is the man of optimism. He does not admit that a thing is impossible. He is not easily discouraged. He forges ahead, despite the obstacles and oftimes in the face of ridicule. And he is eternally dissatisfied with things as they are.

Without men of vision the world's clock would have been turned back centuries ago. In our own day we can see what men of vision have accomplished. As we witness the wonders of science and industry which are being unfolded before the eyes of our generation every day he would be a rash prophet indeed who would predict a pessimistic future for mankind.

On the other hand some of you engineers may be pessimistic about your own futures and may have become discouraged because top management has not given due consideration to some of your reports. But you should not be discouraged. If your ideas are good they will be accepted when properly presented and if you have the persistency to get them a fair hearing.

I, for one, am confident that there are great opportunities ahead for the engineer who devotes himself to this type of analytical work and who approaches management research with the engineering type of mind. With his ability and vision he can find an excellent place for himself in an industrial organization. Top management needs scientific research and it is up to the engineers to accept the challenge brought about by the modern demands for economic products and social forms.

* * *

Fitting Injured Men to Regular Jobs

JOHN V. GRIMALDI, National Conservation Bureau, Association of Casualty & Surety Executives.

The successful placement of the physically impaired depends primarily on good personnel or management planning. If the job is well done, there should be a minimum of work for the engineer to do. The objective of the selective placement program is to fit the man to the job, not the job to the man. Thus, engineering revision of a job as a basic means for placing a physically exceptional worker is frowned on and should be used only as a last resort.

However, before one can recognize fully the employment equality between the impaired and the normal worker, he must cleanse his thinking of any misconception concerning the impaired. He must be able to look at a noticeably impaired worker objectively, and remember that a twisted, deformed or

HYSTER

Industrial Trucks do more work...

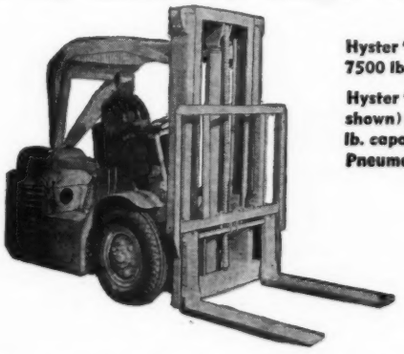
YOUR BUSINESS can cut handling costs and increase net profits when a Hyster industrial truck lifts, transports and stacks materials.

This mechanical expediter on wheels does an amazing amount of work—*saves time and money*—releases manpower for more productive jobs in factory, field or warehouse.

Hyster models range in capacity from 2000 lbs. to 30,000 lbs. All models are *pneumatic tired*, gasoline powered, engineered and built for fast, efficient, enduring service. Illustrated literature sent gladly... Distributor sales and service in principal cities.

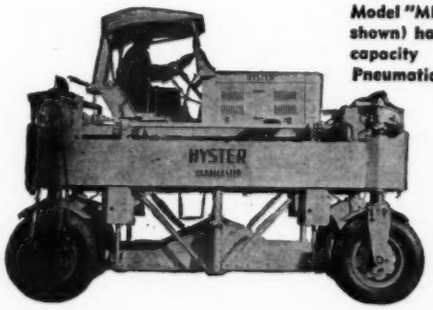
Hyster "20"
2000 lb. capacity
Pneumatic tires

Hyster "40"
4000 lb. capacity
Pneumatic tires



Hyster "75"
7500 lb. capacity
Hyster "150" (not shown) has 15,000 lb. capacity
Pneumatic tires

Hyster Karry Krane
10,000 lb. capacity
Pneumatic tires
Mobile crane truck with adjustable boom



Hyster Straddle Truck "M"
12,000 lb. capacity
Model "MH" (not shown) has 30,000 lb. capacity
Pneumatic tires

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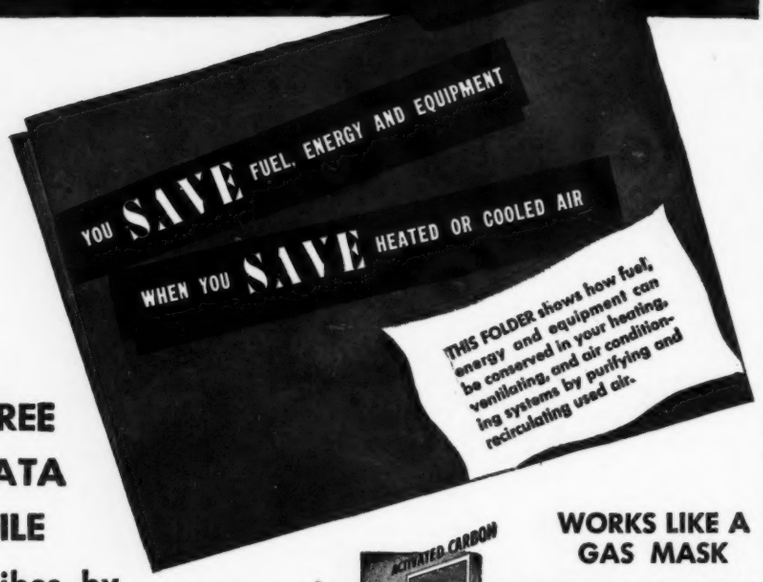
SAVED FUEL, POWER, and AIR CONDITIONING EQUIPMENT

simultaneously improved indoor air quality.


YOU SAVE FUEL, ENERGY AND EQUIPMENT
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describes by example how the basic principles of Air Recovery (the extraction of gaseous and odorous impurities with activated carbon) can be profitably applied to any commercial or industrial heating or air conditioning system.

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Nothing is added to the air. Vaporous odors and impurities are *extracted* not *disguised.*

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Company .....
Address .....
City ..... State .....

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AIR RECOVERY • AIR PURIFICATION • AIR DIFFUSION

114 East 32nd Street — **New York 16, N. Y.**

lame body may be equipped, for example, with a fine mind or be capable of extreme dactyl dexterity. An impaired person may have any grouping of a number of outstanding abilities.

It is generally our unfamiliarity with severe impairments that corrupts our thinking, so that we evaluate the impaired solely in terms of the deficiencies we see. It would be more appropriate if we regarded such workers not as physically disabled, but as physically exceptional, so that the connotation of physical limitation is avoided. Because, as we now know, when the physically exceptional person is properly placed, he will be a desirable employee.

When a worker is properly placed so that the disability does not affect efficiency in a particular industrial job, the disabled workers frequently are more efficient than normal workers. . .

The so-called rehabilitation problem and the resultant studies for its answers have a deeper significance than we might casually observe. The humanitarian and economic motives that touched off the demand for research investigations have done more than just aid the previously almost forgotten handicapped man. They have brought results that will show the way to better personnel procedures for all working men. The development of new personnel methods and the worth of some now used that have been proved through these studies should be applicable towards improving the success, morale, and safety of all workers.

A full program for successful placing of impaired workers requires the following elements: A definite company policy on rehabilitation, including instruction of the supervisory staff in proper principles; analysis of jobs with specific reference to possible hiring of disabled workers; a standardized interview for such applicants; medical determination of an applicant's physical capabilities; matching man to the job, with attention both to physical ability and background; job training; and periodic review of results of such job placements.

* * *

Optimum Area of Collective Bargaining

LEE H. HILL, Publisher, *Electrical World and Electrical Contracting*, New York

One of the most difficult and basic problems in the entire field of collective bargaining is to determine just what is the area of collective bargaining. What subjects are within the appropriate field of collective bargaining? Should management and union bargain about basic wage rates? Hours of work?

Frank Adam DUBLBRAK AUTOMATIC CIRCUIT BREAKER Panelboard

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GREATER PROTECTION
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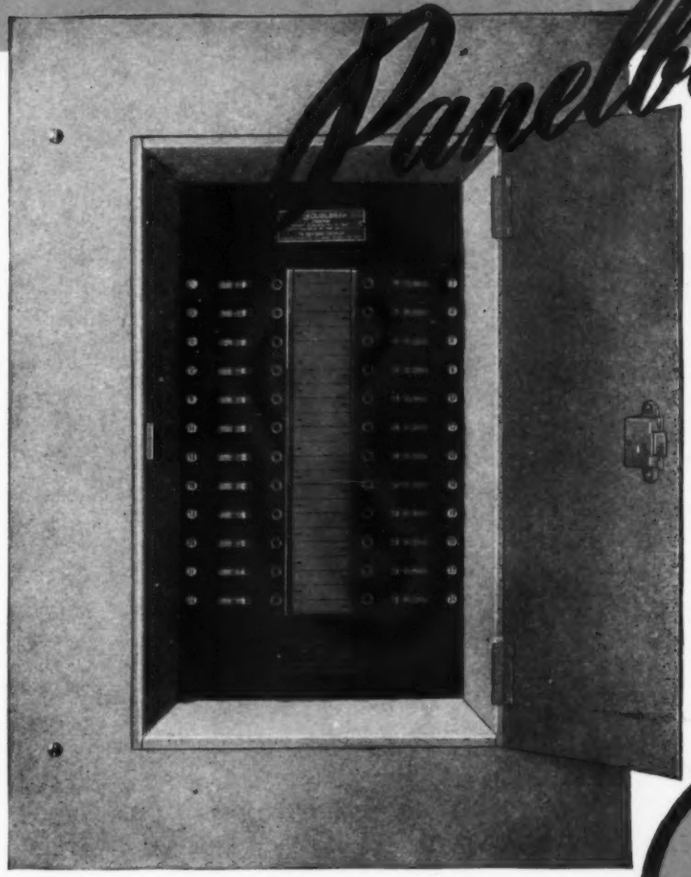
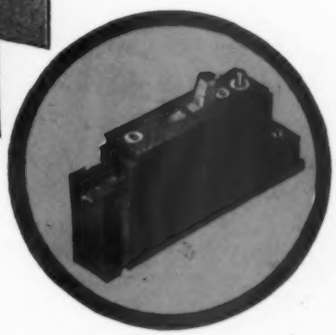
MORE EFFICIENT OPERATION THAN EVER BEFORE





Here is a panelboard as modern as tomorrow! Designed for lighting and appliance branch circuit protection and control, nothing has been spared to meet every requirement. Compact and attractive to please the architect . . . scores of knockouts, 4-inch gutters, adjustable leveling to please the contractor . . . nothing to replace or service to please the maintenance men . . . years and years of trouble-free service to please the owner . . . and quality materials and workmanship to please ourselves.

Everyone is delighted with this panelboard. Stores, offices, factories, schools, hospitals, commercial and public buildings have found it meets their requirements perfectly.

The FA *Dublbrak* Panelboard has the "extras" you want. Individual circuit breaker construction. *Automatic* thermal protection against overload and short circuit. Time-lag for harmless momentary overload. *Quick* make and break operation on manual and automatic trip. Red button indicator for speedy location of automatically tripped circuit breaker. Entire front is shock proof and tamper proof. Heavily silvered, double break contacts adds years to the life of the panelboard.

Capacities of 15 to 50 amperes for alternating or direct current. Double or triple pole assemblies with individual trip per pole are available. Write today for Bulletin No. 67 giving specifications, prices and many helpful suggestions.

Frank Adam ELECTRIC CO.
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So you can Count on these 3

To the inherent characteristics of steel floor plate (such as durability, ability to stand tough traffic, oil, heat, fire and crackproof and no maintenance cost) add, for A. W. Super-Diamond these three distinctive advantages well worth knowing about for safer floors. Notice the shape of the elevations and the pattern? 30% minimum contact area with the shoe. Sloping sides that maintain "sharpness" of contact, resist dirt collection, make for easier cleaning, better draining. And a pattern that matches more easily with less scrap! These are reasons why alert architects, builders, product engineers, and purchasing agents are insisting on AW Super-Diamond Floor Plates.

Write For 16 page Booklet L-31 Giving Helpful Information on Weight Per Square Foot and Maximum Sizes. Alan Wood Steel Company, Conshohocken, Pa.

AW SUPER-DIAMOND
FLOOR PLATES THAT GRIP
A Product of ALAN WOOD STEEL COMPANY

Sales policies? Selling price of the company's products or services? Financial policies? Intra-union disputes? Jurisdictional union disputes?

The lack of a definition of the field of collective bargaining breeds fear and distrust. It may even arouse opposition to union demands which in themselves might be acceptable but are rejected because they may lead to invasion of important management functions. Union leaders complain that management does not really and genuinely desire to bargain collectively. The point is that management has, on the whole, accepted collective bargaining as an essential part of the industrial scene. But some managements have dealt and do deal with unions "at arm's length" simply because they are dealing with an unknown quantity. They do not know whether the union will live up to a signed agreement and they do not know how far unions may go in invading management's functions—and they fear the worst. And management, having learned by sad experience that collective bargaining has resulted in the loss of some functions which management found essential if it were to continue to manage the plant successfully, can hardly be criticized for being somewhat circumspect in its approach to the bargaining table.

True, genuine, successful collective bargaining is hampered not only by actual union demands within the management area, but also by the well-grounded anticipation on the part of management that such demands may be made. Management is aware that unions are attempting to unionize certain strata of management itself, thereby making of management a house divided. Management knows that unions have demanded the transfer to the union of certain essential managerial functions, such as the maintenance of discipline, and management knows the disastrous results that have followed when such a demand was granted.

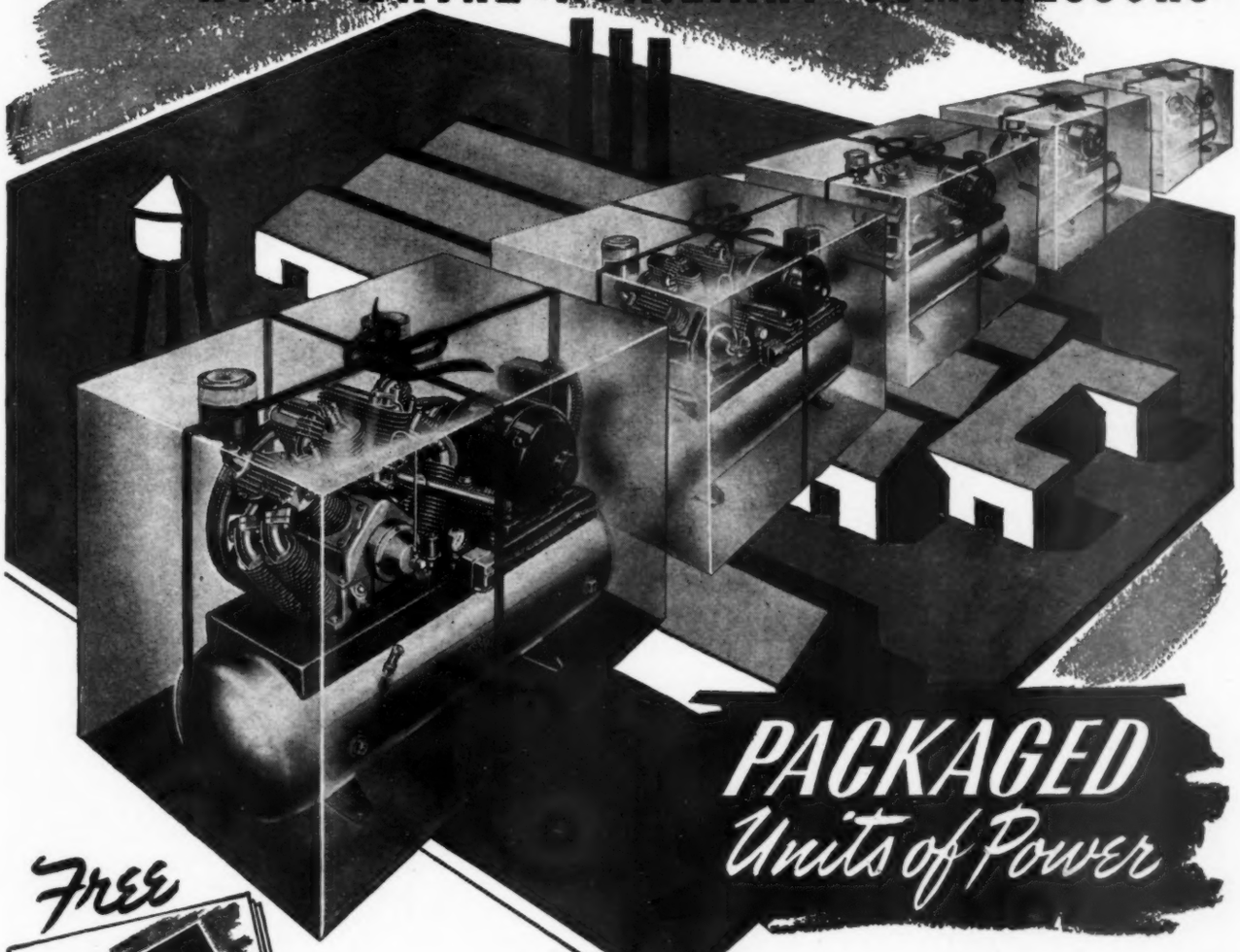
Management is also aware that the unions' attempt to limit its effectiveness in the discharge of its functions is not always approached directly. Unions have discovered that indirect approaches have succeeded where direct attacks have failed. Such flank attacks include the following:

1. Proposals requiring mutual consent of management and union before any decision can be put into effect, lodging an effective veto power in the union over such matters as, for example, setting disciplinary penalties, making transfers, promotions, demotions, etc.

2. Demands for joint committees with authority (not advisory) to carry

Decentralize Air Supply

WITH WAYNE AUXILIARY COMPRESSORS



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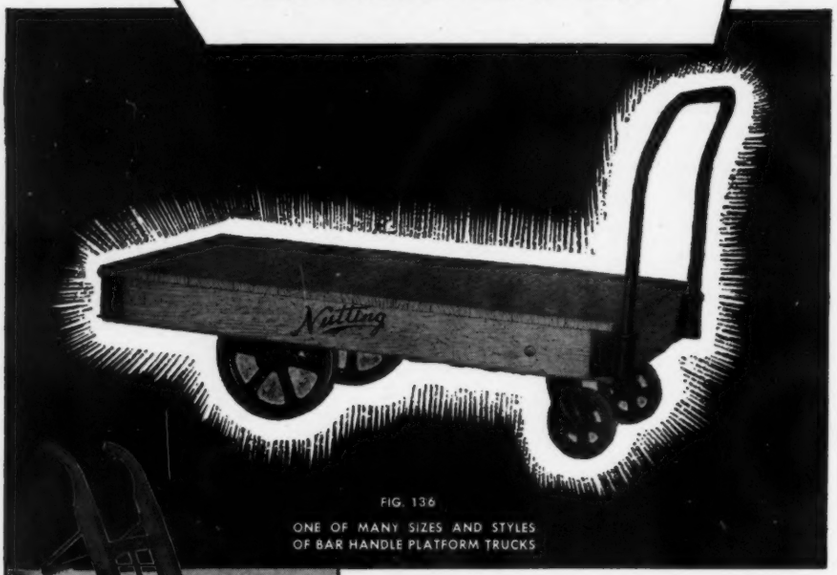

FIG. 136
ONE OF MANY SIZES AND STYLES OF BAR HANDLE PLATFORM TRUCKS

FIG. 16-24 TWO-WHEEL TRUCKS FOR EVERY USE

FIG. 419-421 JACK AND LIVE SKID

CASTERS, ALL TYPES, LIGHT, MEDIUM, HEAVY DUTY

WHEELS WITH DEMOUNTABLE RUBBER TIRES

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Your materials handling system needs to be just as carefully planned and engineered as your production set-up, or the design of your products. A planned layout may well be the difference between profit and loss, between smooth-flowing operation and a time-wasting series of bottlenecks. Take advantage of the seasoned experience and valuable advice of a Nutting Engineer. Because the all-round adaptability and versatility of Nutting Trucks has never been excelled, he can advise you on the proper use of trucks with overhead or floor conveyors . . . assembly or production line use . . . inter-departmental use . . . warehouse or shipping room use . . . as well as situations where only trucks should be used.

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out certain managerial functions, such as determination of merit increases.

3. Demands for a rigid seniority structure, such as one depriving management of any opportunity to assign the best-qualified employees to specific jobs.

4. Proposals that every decision of management be subject to reversal by a referee who can hardly be expected to have as much background on the situation as does the management, and who has no responsibility for the success or failure of the business.

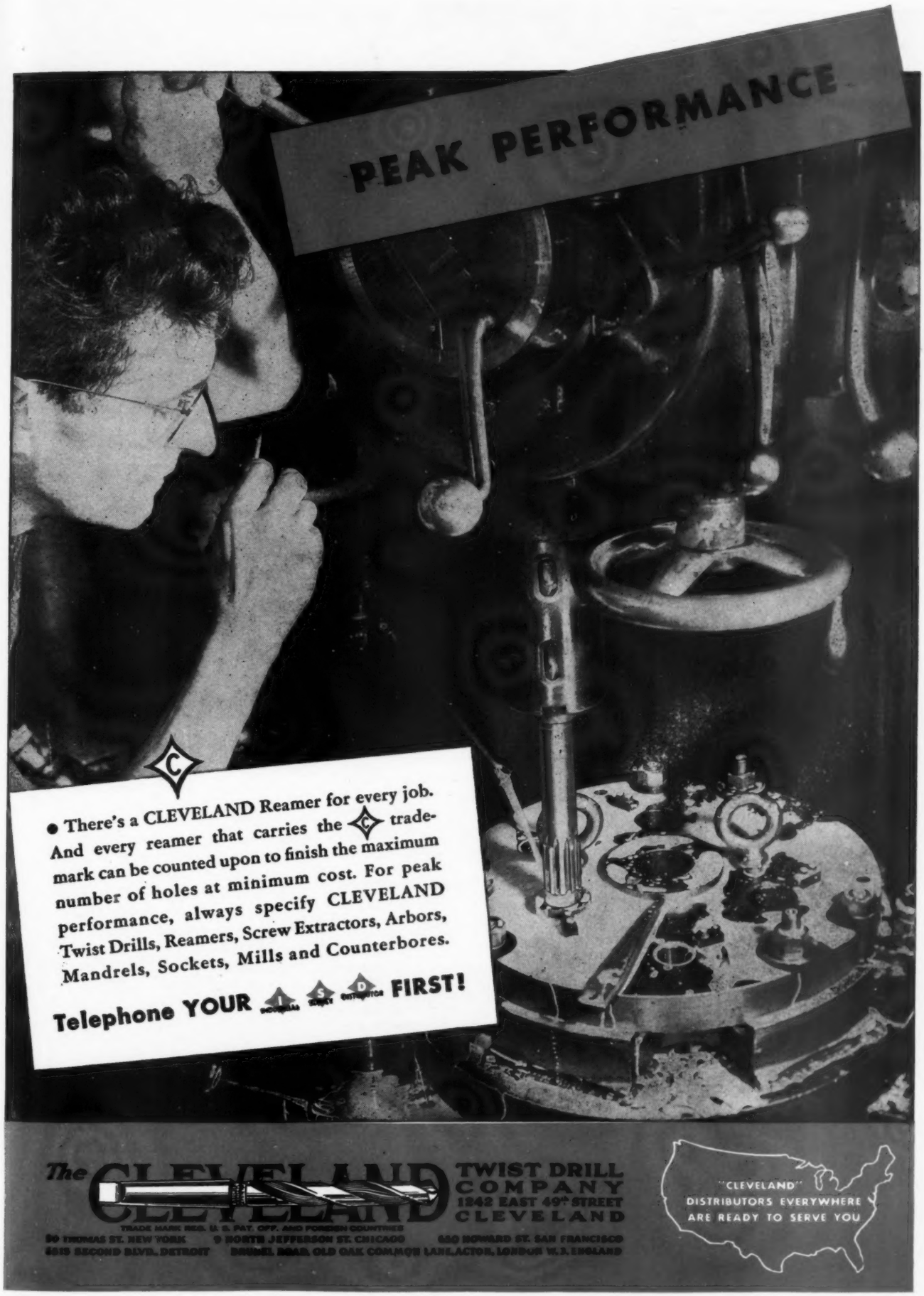
Great progress in every area of collective bargaining would be made if the unions would officially declare their agreement that certain areas are management's exclusive concern and responsibility, and that they would not make any demands which impinge on those areas. Such a statement, if lived up to, would remove a great obstacle from the path of understanding between management and labor, and make it possible for the parties to negotiate in an atmosphere of give and take, rather than fear and prejudice. . .

The area of collective bargaining would be far better clarified if unions would publicly state and live up to a full and genuine recognition of the inherent right and responsibility of management to exercise the usual rights incident to ownership of the enterprise and management's unqualified right to direct its operation.

Managements' Functions

Among these inherent managerial functions, but by no means a complete list of them, are the sole responsibility to determine the product to be manufactured or the services to be rendered and the prices to be charged therefor, the location of the enterprise, the schedules of operation and the methods and processes to be used; the right to hire, promote, discharge, or discipline for cause; the right to maintain discipline and efficiency of employees, to judge performance as to quality and performance of work, to control the working force, including allocation and assignment of work and workers.

Aside from an agreement on the part of unions not to seek to take over management functions, management's legal obligation to bargain collectively should be clarified by amending the National Labor Relations Act to specify what is meant by such terms as "terms and conditions of their employment" or "grievances, labor disputes, wages, rates of pay, hours of employment, or conditions of work," or "rates of pay, wages, hours of employment or other conditions of employment." Since the law provides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that employers are required to bargain collectively concerning "conditions of employment," this broad and vague term should be defined so that both parties may know the extent of this legal obligation.

Such a definition of employer's obligations would still permit employers to bargain about any other matter of *mutual* interest, but it would and should clear the air by letting both parties know the subject matter on which collective bargaining is legally required of the employer.

To fill out the definition of collective bargaining it might be well to indicate areas which should be specifically *excluded*. I submit that the internal operation and organization of the company and the internal operation and organization of the union are fields which should be specifically excluded from the area of collective bargaining.

This means that the union has nothing to say about who shall be president of the company; and the company has nothing to say about who shall be president of the union. The union should have no influence on the selection of the foremen; and the company should have no influence in determining which employees shall be union stewards. Nor should the union have anything to say about the company president's salary nor the company about the union president's union salary. Each should respect the internal operation of the other as excluded territory.

Other subjects that should be excluded from the area of collective bargaining are the questions of union recognition and of which union shall represent a group of employees. These should be subjects for factual determination, rather than collective bargaining.

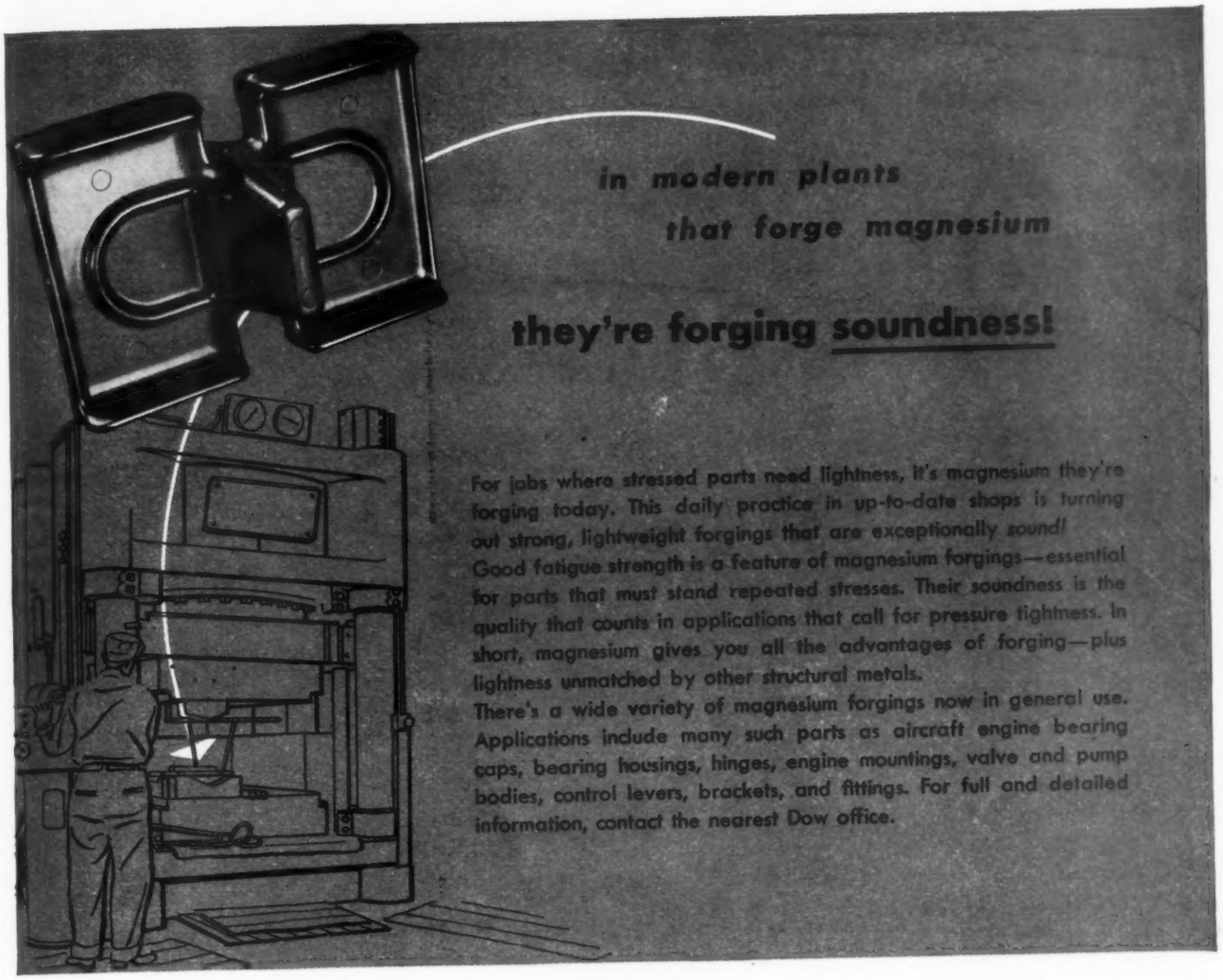
Particularly deplorable are those disputes (during which the employer is frequently but an innocent bystander) that are caused by jurisdictional quarrels between unions, whether they are caused by desire of two or more unions to represent a given group of employees, or whether they are caused by multi-union claims of jurisdiction over a specific type of work. . .

By taking questions of recognition and jurisdiction out of the area of collective bargaining we shall have eliminated a fertile source of extremely embarrassing and unjustified disputes.

Steps Recommended

There is good reason to believe that collective bargaining will receive much readier and more wholehearted acceptance from management if the unions will do these things:

1. Eliminate union recognition dis-



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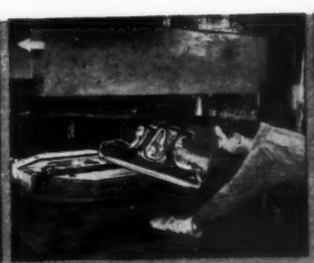
Dow's ample supply of magnesium includes forging alloys prepared for superior properties and desirable characteristics.



Modern facilities for forging magnesium are available in Dow's shops and those of many independent fabricators.

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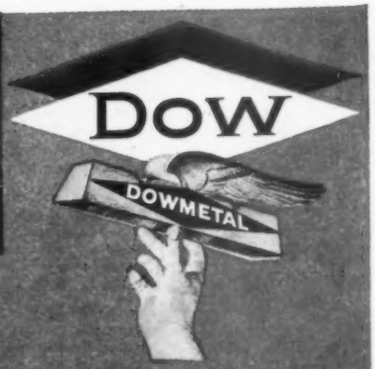

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In servicing the Bronze "Renewo" and Iron Body "Ferrenewo" Valves—both regular and plug types—only *one stock of parts* is required. *All* parts (except bodies and bonnet rings) are made exactly the same and fit each other perfectly.

Repairs are more quickly and easily made, ordering and handling are simplified. The result: Lower maintenance cost and low ultimate valve cost.

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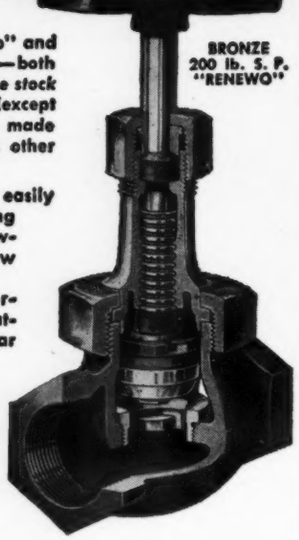
Ask your Lunkenheimer Distributor for a copy, or write direct.


BRONZE
200 lb. S. P.
"RENEWO"

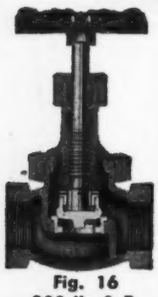


Fig. 16
300 lb. S. P.
Bronze "RENEWO"

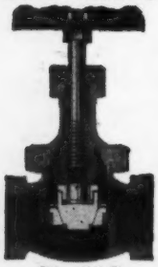


Fig. 16-P
300 lb. S. P.
Bronze Plug Type
"RENEWO"

VALVE MAINTENANCE SIMPLIFIED!

All parts of these valves (except bodies and bonnet rings) are exactly the same. They fit each other perfectly.

For example—if you need a stem, disc, or seat ring for the "RENEWO", you can use the corresponding part of the "FERRENEWO", and vice versa.

Thus there are fewer parts to be carried, repairs are more quickly and easily made. The labor, time, and expense of valve maintenance is cut down—'way down!

SAVE THIS WAY, TOO!

For severe throttling service, a regular type can be converted into a plug type, by simply changing the seat and disc, without taking the valve out of the line.

Thus it's not necessary to buy a whole new valve—just a matched set of plug type seat and disc which interchange perfectly in corresponding patterns and sizes in a range of pressures from 150 to 350 lb. S. P.

Lunkenheimer simplicity of design, minimum number of parts, and fine precision workmanship make this and other outstanding economies possible.

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THE LUNKENHEIMER CO., Cincinnati 14, Ohio
(OFFICES: NEW YORK 13, CHICAGO 6, BOSTON 10, PHILADELPHIA 7.
EXPORT DEPARTMENT: 318-322 HUDSON ST., NEW YORK 13, N. Y.)

putes, jurisdictional disputes, and other interunion disputes from the area of collective bargaining by invoking the services of the NLRB (or corresponding state boards) to determine appropriate bargaining units and the legal bargaining agencies.

2. Refrain from attempting to organize elements of management to bargain collectively with management; and to join management in seeking to amend the NLRA so as to make it clear that management is not legally required to bargain collectively with its own representatives.

3. Refrain from invading managerial functions through collective bargaining demands, directly or indirectly, and let management know that this is a basic element of union policy.

4. Join with management in seeking to clarify, through amendment to NLRA or the regulations thereunder, the area in which employers are legally required to bargain collectively with representatives freely chosen by their employees.

5. Take steps to insure that, once a collective bargaining agreement has been signed, the union will live up to it, and will not seek to protect those who violate it. Managements have justifiably wondered why they should go through the ordeal of collective bargaining if the agreement, when finally reached, is later to be disregarded, as it is by some unions.

These five steps can go far to make collective bargaining the constructive force for industrial peace that its friends hope it will be. Genuine collective bargaining cannot be legislated, it can be brought about only by creating conditions in which it can flourish.

* * *

Unionist's Plan for Production With Freedom

EDWARD T. CHEYFITZ, National Chairman of the Casting Division of the Mine, Mill, Smelter Workers, CIO

Industrial relations is our No. 1 domestic problem. Upon its successful solution hinge such issues as rapid reconversion, sustained high level of employment, and other vital economic problems. Unless we arrive at a labor-management understanding, we cannot proceed to solve any other economic problems facing America.

What is the solution of our labor-management situation? Some people suggest "curbs." They feel that legislation will solve the problem. At best, legislation is negative, and in this day,

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PROBLEM: To haul 112 tons of crushed glass each 14-hour day — 365 days a year, and through drastic temperature changes.
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This rugged conveyor belting is made by the famous ROTOCURE process of continuous vulcanization that insures stamina and ease of operation, regardless of how abrasive the load. This BWH belt has run continuously since July 7, 1942, and . . , at a lower maintenance cost.

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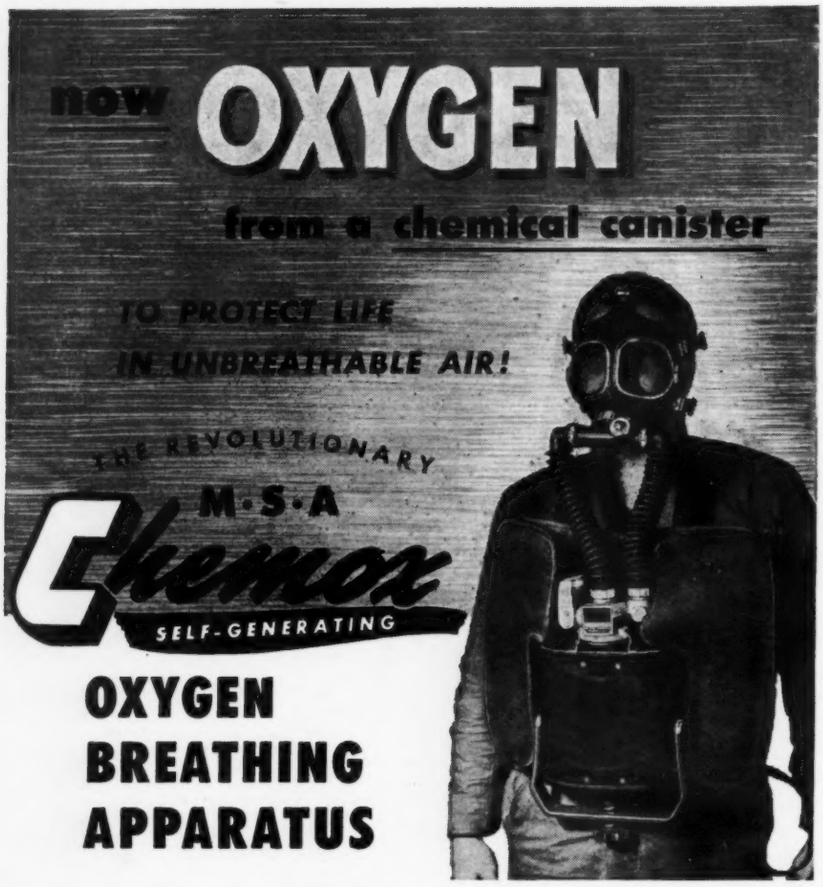

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when all of us are striving for less government in our economic affairs, the proposal for more government is not too sound. There are other people who suggest that what is needed is labor-management cooperation; that if men of good-will sit around a table they can solve their problems. Cooperation in and of itself solves nothing. Are we to have cooperation in a vacuum? Cooperation must always be around certain principles and for certain objectives. The answer is neither cooperation nor curbs, in and of themselves, although both might be useful to implement principles and objectives.

We need a national industrial relations policy based upon the concept of democratic living in industry. Sound policy is always based upon principle. Let us examine the forces that operate in our workshop. While I do not discount man's drive for more and more wages, more and more of the material things, I emphasize man's drive for individual freedom and personality expression. That is a basic motivation for unionization. The other basic force in the factory is management's drive for production. This encompasses the profit motive.

Our national policy on industrial relations, therefore, based upon these two motivating forces, calls for the acceptance of three principles:

1. Accept the union and collective bargaining.
2. Accept management's right to manage.
3. Accept production.

I call this national policy based upon the three principles "Production With Freedom," and offer it as the compass in our present industrial wilderness of emotions and prejudices. By this compass we may steer our course. With this yardstick we can solve the daily industrial relations problems. Against this background we can derive the successful patterns for democratic living in the workshop.

* * *

More Science Needed in Management

REGINALD E. GILLMOR, Vice-President, Sperry Corporation

Management's greatest responsibilty and opportunity is the advancement of the art of administration. It is a great responsibility because the governing of men underlies and controls the progress of all other phases of human relations. It is a great opportunity because the development of new concepts in any field of management—industrial, for example—will be of value in all other fields, governmental and social.

To begin with there is a great need

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for precise management terminology. No science or art can progress very rapidly until the terms employed in it are carefully defined. The physical scientist knows exactly what he means when he uses the terms erg, ohm, and a vast lexicon of other precisely defined scientific terms.

Management's terms are for the most part vague and ambiguous. Consider, for example, the absence of precision in the words government, administration, control, coordination, management. All of them have a variety of meanings and some of these meanings are common to all of them; in fact, management can be interpreted to mean any or all of them. . .

A Lack of Set Principles

In the art of organization and administration there are no *generally accepted* principles. To be sure, many excellent books have been written on the philosophy, the principles, and the practice of administration, and there is some general agreement among management engineers as to such principles as definiteness of function, correspondence of responsibility and authority, limitations to the span of control, maximum delegation and autonomy, and the separation of planning from executive functions. For the most part, however, the principles are looked upon as academic and are more honored in the breach than the observance.

Many industrial organizations do not even subscribe to the principle of defining the responsibility and the corresponding authority of the various positions in the organization . . . No man can make full and effective use of his talent and energy unless he knows for what he is responsible, to whom he is responsible, and how he is to be judged.

Absence of adherence to principle also leads to continual change in organization structure. In far too many cases the structure is designed for the individuals who are available. The proper way, of course, is to design the organization structure in accordance with sound principles, and choose the individuals to fit the structure.

Another indication of the backwardness of the art of administration is the fact that no qualifications in education and training are required to practice the art. A doctor of medicine cannot practice until he has met definite standards of requirements prescribed by the state in which he is to practice. Almost everyone thinks he would be a good executive, and there is no way to determine whether he is or not, except by the expensive process of trial and error. Such training as is given to executives is usually applied at the lower

cut materials handling costs with NORTHROP GAINES products

Airlight hand trucks

Light, balanced, and free rolling. Aluminum alloy frames are resistant to corrosion, impossible to splinter. Smooth surfaces shed dust and dirt. Equipped with high capacity, factory lubricated Airlight wheels.

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Airlight aluminum alloy casters are 40% lighter, carry loads up to 10 times rated wheel capacity smoothly, safely and easily. Timken Tapered Roller Bearings for instant swiveling. Factory lubricated for life.

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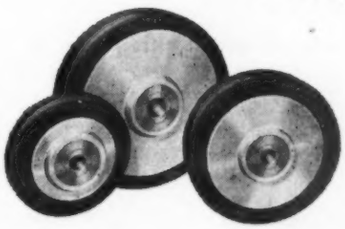

If the saving of man hours or the paring of production and distribution costs mean anything in your business, you can now benefit from the advanced design of Northrop Gaines materials handling equipment. In Northrop Gaines Airlight hand trucks, wheels, casters, and flat beds you will find exceptional strength and durability, light weight and smooth action.

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levels—the result often being to make the lower levels critical of their seniors when they find that the senior does not practice the precepts which have been taught to the junior.

One of the most difficult problems in human relations arises from the indefiniteness of management's social responsibility. Its only direct responsibilty at present is toward its stockholders; it cannot assume responsibilty for building up purchasing power as well as purchasing desire, but unless it is given that responsibilty, all stockholders will suffer from decreasing markets and profit margins as well as high taxes and social instability resulting from widespread unemployment.

Union Situation Is Similar

A similar situation exists in union management; its principal responsibilty is to get the highest possible wages for its constituents, but carrying this to an extreme results in increased costs, higher prices, and the dangers of inflation, and unemployment. No doubt the leaders in both management and labor fully appreciate this problem, but they do not have the authority to solve it. . .

We in management are pioneering in one of the most important and difficult phases of the relatively young art of human relations. While taking satisfaction in the progress we have made, we must not forget that the art of human relations with its essential component, management, is now the limiting factor in the progress of mankind.

We must make further and faster progress by applying the scientific and engineering technique of disregarding the conventional, discovering and accurately expressing the fundamental laws, and cooperating with one another to gain the general acceptance and application of those laws.

•

Materials, Wages, Costs in the Post-War World

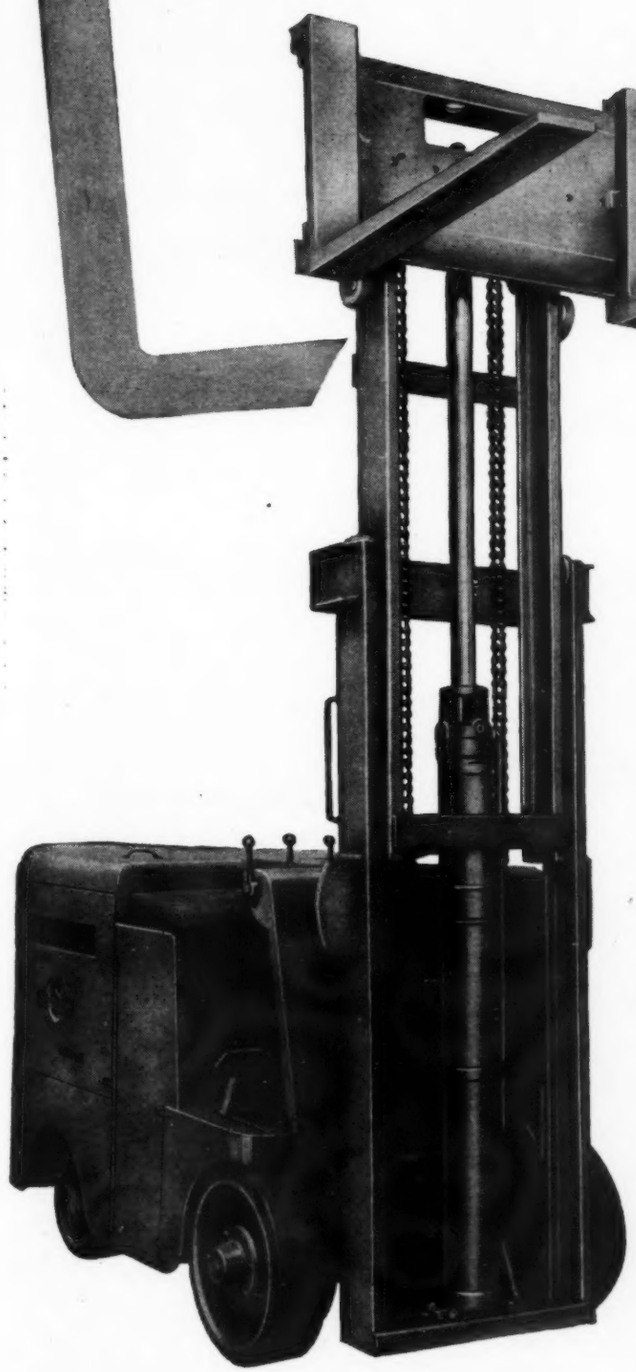
(Following are excerpts from talks given before the recent annual meeting of the Society for the Advancement of Management.)

Basic Problems in the American Economy

WILLIAM L. BATT, Civilian Production Administration

Americans traditionally have been indifferent to their interests in raw materials supply. It has been our comfortable habit to think of the United

LET THE NEW PALLETIER RAISE YOUR LOADS AND Lower Your Handling Costs



WHAT is the fastest, easiest, most economical method of unloading and storing material? Time study men have found that the more you can handle in a single operation, the lower will be your cost. For *peak* handling at *top* speed, the new Crescent Electric PALLETIER is the answer.

After nearly eight years of research—with an eye on your needs—the Crescent PALLETIER is ready to lift your loads and lower your handling costs. Built for fast, safe, easy handling, it will pick-up, store and unload packaged material in a jiffy. Silent, quick, nimble as a cat, it will purr through your warehouse, slip into narrow areas, speed up inventories and reduce damage to merchandise caused by excessive handling. You'll be able to use more storage space, too. The standard PALLETIER will negotiate a 7-foot car door and can store material 108" above the floor. With forks inverted, it can store 132½" above the floor.

The new Crescent Electric PALLETIER has been designed for dependable and efficient service. Protection against forced acceleration is safeguarded by full magnetic controls. Foot-operated electro-mechanical brakes are mounted on each driving wheel. Emergency braking is provided by direct-acting mechanical wheel brakes from the same foot pedal or from the operator's seat. Exceptional stability in handling heavy loads is further increased by the location of the trouble-free tilting cylinder.

Easy access to all mechanisms adds to the long procession of PALLETIER advantages that make it the last word in low-cost materials handling. Send for complete details and specifications today.

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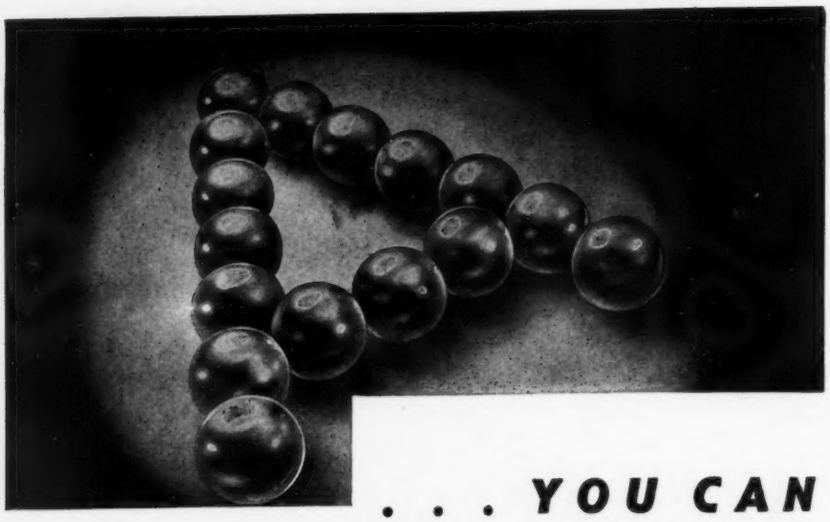

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States as a land of unlimited material resources. The familiar materials like iron and steel we had in abundance, and it was easy to assume that we were similarly rich in all those things needed by an economy that had grown as ours had. We overlooked two vital facts:

1. Many of our most essential items had of necessity to come from abroad because they were not found here.

2. Our own supplies might some day be used up.

As to the first, such critical raw materials as tin and nickel do not exist in the United States, at least not in usable quantities. No completely satisfactory substitutes have been found for either. We must look to foreign sources for these as many other less well known, but vitally important, materials.

As to the second, it is painfully clear that the abnormal demands of two wars plus two decades of heavy civilian consumption have taken an irreplaceable toll. Our high grade iron ore deposits in the Mesaba range have not many years left. The deposits from which high-grade zinc concentrates are produced are being rapidly exhausted. Our good copper deposits will be a thing of history in another 25 years. There is much argument about petroleum, because of the unknown nature of possible reserves, but many authorities will tell you that our petroleum resources may well approach the scarcity range within this lifetime.

We never had much high-grade bauxite—the familiar base for aluminum—and we have used up a good part of these limited resources in the recent emergency.

Future Scarcities

I could give many more examples, but this will be enough to emphasize the point I want to make, and that is that the United States is passing, slowly but surely, from a country of plenty to a country of scarcity in the field of metals and minerals and other essential supplies. It will be said, of course, that we have reserves of low grade materials that we could fall back on, and to some extent we could, but at much higher cost and with great difficulties.

Our technical and scientific skills will, of course, find new materials by the synthetic route. Some of these will take the place of items in short supply. Some will open up new fields of use. But important as the development of these new synthetics is, they can hardly be expected to make up for future possible domestic shortages in many of those bulk, low-cost materials such as

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Available in ratings from 600 Amperes to 4000 Amperes, 600 Volts or less, it is the most efficient and economical distribution system now available for Feeder and Welder Circuits.

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THE "OTHER 3 MEN" JUST AREN'T THERE

With the amazing new motorized *HYDRO-Lectric* Lift Truck, one man automatically does the work ordinarily requiring four.

Actually, a *child* can operate the *HYDRO-Lectric* because it responds instantly to "finger-tip" control. No physical effort other than steering is required.

The *HYDRO-Lectric* is a brute for strength and stamina. Users claim it easily whisks along the heaviest loads . . . . gives constant 24-hour-a-day service with negligible downtime . . . . pays for itself *five or more times a year.*

We think you'll agree this is something worth investigating. Send for folder "A" on the *HYDRO-Lectric* and other Stuebing-designed single and multi-stroke hand lift trucks.

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LIFT TRUCKS, INC.

Walter Stuebing, *President*

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copper and zinc—perhaps high-grade iron ore and petroleum, that have made such contributions to the development of our mass production efficiency.

It may not be stressing the point too far to suggest that we are moving toward an economic position similar to that in which England has found herself, that of having to depend on imports in order to maintain her very lifeblood of existence. It may hurt our pride, but harden our decision, to ask ourselves if the remarkable combination of assets which enable this country to develop its fantastic strength, are gone forever.

Some of these assets, however, we need never lose. We may waste them through carelessness, dissipate them through indifference, but they need not inevitably be used up if we will it to the contrary.

The great American asset of skill is ours for always if we wish it that way. No country in the world has had so high an average of individual skills as this one. More and better goods have steadily been produced and generally at lower and lower prices in terms of real wages. Invention and development have proceeded without material interruption. The electrical industry, the automobile industry, chemicals and plastics—these and many others—have increasingly contributed to a better standard of living, to higher wages and shorter working hours.

The American people, with their wealth of material resources, their skills, and their cooperative approach, have undeniably created the most powerful nation in the world. But with this power must go responsibility. Responsibility to our own people at home, whose living has, to so large a degree, been integrated into a national fabric through the growth of business units and urban concentration. Responsibility to other nations, whose well-being is more and more dependent upon what we do. Our export and import policies, our lending policies, our control of immigration, and just the state of our internal prosperity—all these currents in our domestic picture may well grow to tidal waves as they reach foreign shores. Whether we like it or not, we have a responsibility for cooperation with the rest of the world, which we dare not evade or avoid.

Grounds for Optimism

Now cooperation is a trait of the American people, and the cooperative approach in the solution of our more obvious problems at home, at least, should present no basic difficulties. The almost nation-wide conflict today between labor and management is serious

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Distinctive, the World over, is the head of a Toledo Scale. In factories, dairies, mines or mills—wherever seen it means—*Accurate Weight.* For inside the Toledo head is that ingenious Toledo full-floating, double-pendulum device which balances weight against weight to give accurate weighings with split-second speed.

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TOLEDO

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have you overlooked *Oil Purification?*

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If you are interested in reducing manufacturing costs, ask yourself these two questions:

? Is there an operation in our plant where oil purification would reduce operating costs (Internal combustion, Diesel or steam engines; turbines; cutting, grinding, boring, honing machine tools; rolling mills; compressors, hydraulic equipment or any other operation in which quantities of oil are used more than once)?

? Do we have Honan-Crane Oil Purification Equipment to handle our problems arising from dirty or contaminated oils? (*Honan-Crane gives more efficient results.*)

Honan-Crane's extensive research and engineering facilities are steadily uncovering valuable information for industry in the science of keeping oil clean. Write today for complete information on the value of oil purification in your business.

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in its effect on reconversion and at some points, it seems to me, inexcusable, but I do not believe it is symptomatic of any fundamental cleavage. Some way or other I think this problem will be worked out.

Cooperation in the international field is more difficult, and the outline of a better future is not so clear. Partly that is so because we have been so self-contained; we have made a comfortable fetish from the usually misquoted advice of President Washington on entangling foreign alliances; partly because so many of our foreign experiences have been unhappy, we fail to distinguish between those widely entered into and those of haphazard incident.

It is only just now that we perceive that our tripartite system of balanced power in government does not lend itself too well to international negotiation, and frequently leaves foreign governments and their nationals in grave uncertainty as to our position. There is no time to waste, as I see it, in finding operating devices at least, which will tend to facilitate such international negotiations and alleviate those dangerous uncertainties. . .

Need for World Trade

A very considerable difference of opinion exists in America with regard to the place of the United States in world trade. Many people who regard themselves as well informed will insist that our prosperity is not materially influenced by the business we do abroad, and particularly when the problem of payment for those goods has to be taken into account. They will point to the relatively small amount of such trade, and conclude that we could as well do without that, if, as they assume to be likely, increased imports and defaulted foreign loans or credits must follow.

Such reasoning is fallacious. Many areas of our country and many industries depend heavily for their very existence, let alone any prosperity, on trade abroad. While the amount of such trade in total may be termed marginal, it can well represent the difference between a prosperous country with a steadily rising standard of living and one where prosperity is marginal and uncertain and the standard of living under pressure to save itself.

The goods we should be bringing in to provide payments for our exports have, of course, the same or greater effects in their home countries.

It can be only a timorous philosophy that does not encourage every effort to enlarge the flow of two-way trade. To provide such an atmosphere, nations must, of course, and ours in particular,

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From this complete line of Control Units (black Bakelite sections) you can assemble any arrangement of Push Button Stations, Pilot Lights or Selector Switches, from simple remote controls to practically any combination required. Push buttons, transfer switches and pilot lights are interchangeable and adaptable to any regular or special combination . . . Standard housings may be had in steel, cast, weatherproof, flush with brass plate and box, or in separate units.

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POWER for materials handling . . . . and a hundred other purposes

MM Industrial Tractors . . . offered in 3 sizes from 27 to 64 H. P. . . . are adapted to heavy drawbar work as well as lifting, carrying and loading or piling raw materials and finished products of all kinds . . . crates, boxes, bales, heavy castings, structural steel, sand, crushed rock, coal, etc. Extra Heavy Duty front axle and tires, heavy Ross steering gear with Twin lever, and heavy cast front wheels make MM Industrial Tractors ideal for use with loaders, lifting forks, lifting cranes, material buckets. Front power take-off drive for operating hydraulic or mechanical lifting arrangements permits control of attachments with tractor standing still or in motion.

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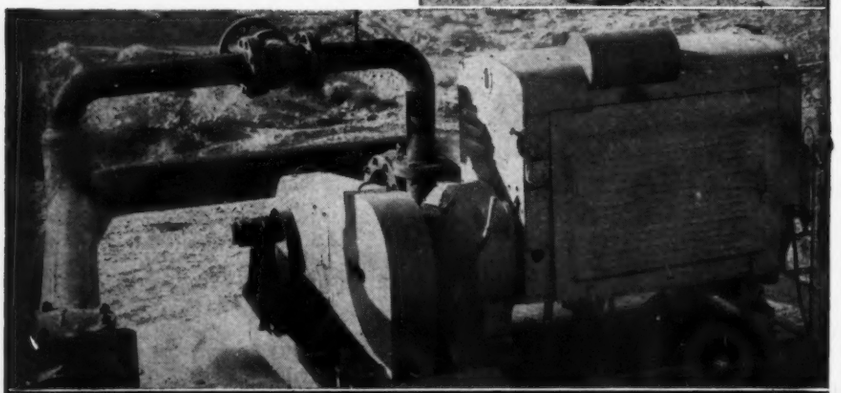
MM Industrial Power Units offered in 7 sizes from 20 to 240 H. P. provide steady dependable power ideal for operating generators, pumps, conveyors, compressors, hoists, winches, cranes.

Complete specifications will be furnished on request.



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fight against unnecessary restrictions on trade. There must be a willingness to lower tariffs, to work against bilateral arrangements, to facilitate good commercial loans and usable credits, to free the operations of shipping wherever that can possibly be done—in other words, really to want to buy from and sell to the nationals of other countries. The people of the United States unhappily still have a long distance to go in this direction; but if they want the maximum of employment and prosperity at home, they have only one way to go. They will insist that their government strengthen its organization in the field of foreign trade and international economics, so that it can deal firmly and promptly and intelligently with other governments; this will involve determining long-term policy, and generally adhering to it from one administration to another.

* * *

Union Labor's Views in Wage Controversy

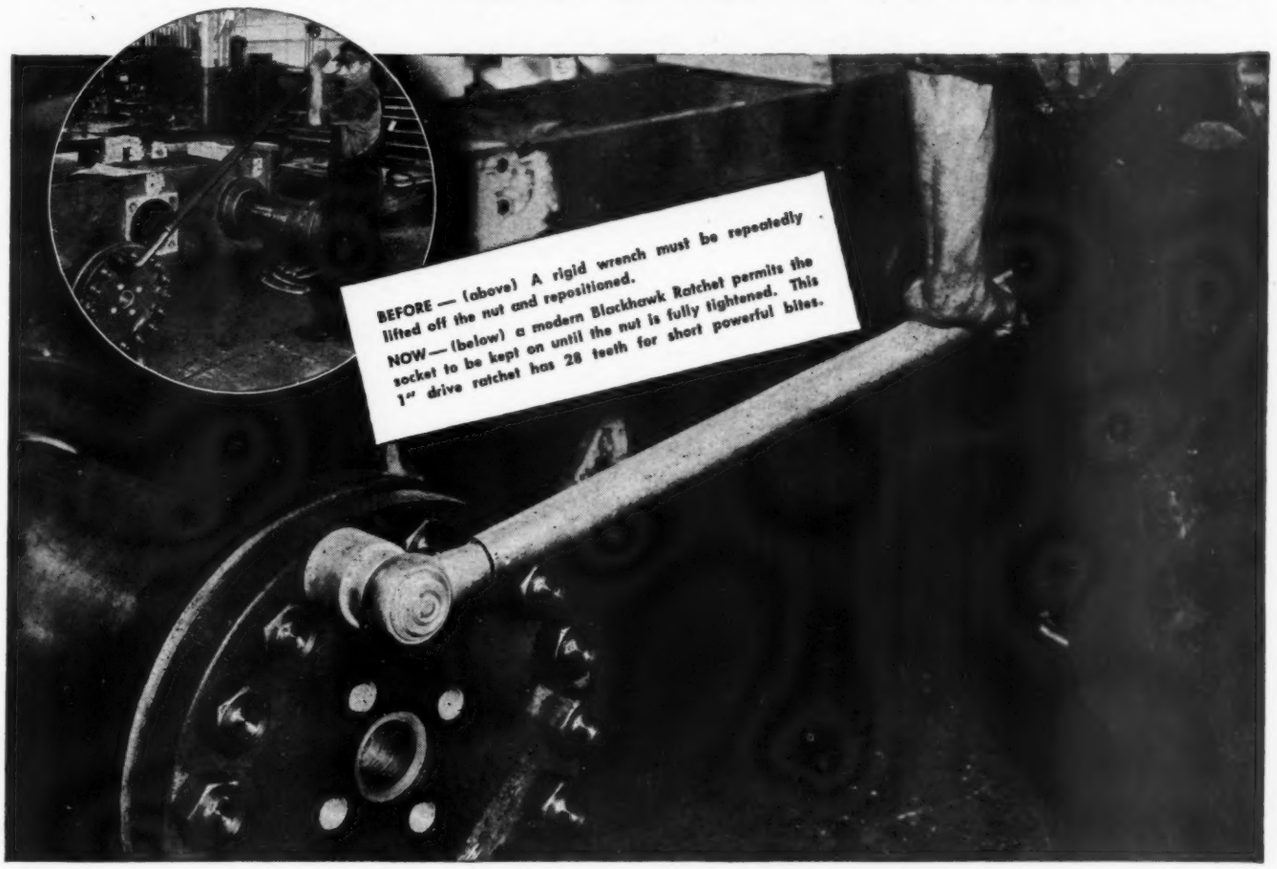
SOLOMON BARKIN, Director of Research, Textile Workers Union of America

Present price controls provide flexible limits within which we are shaping our post-war economy. We hope that it means resistance to price increases; pressure for a more equitable distribution of industry's gains; and a stimulus to greater economic efficiency. It must become a tool for the development of a progressive balanced economy. We cannot tolerate recurrent business depressions and the underemployment of our manpower and resources, with their attendant human and material costs. The war has taught us that we can attain new levels of general well-being. Still higher levels can be shared in peace. Price controls must serve these broader objectives of assuring all Americans economic security, prosperity, status, and opportunity.

Other democratic countries are deliberately shaping their destinies in the direction of balanced expansion. We must review our past and lay out new roads. Our policies have favored expansion but the costs were excessive. We cannot repeat these costly trials since the rest of the world is sensitively integrated with our own economy. We are pressing for even more intimate interdependence. Uninterrupted expansion of our economy, a rising standard of living, and a balanced price structure are vital and indispensable.

Labor's current wage program is an essential part of any program for a progressive, stable, economic society. Unfortunately, our industrial autocrats seized the present differences on wages both to test labor's strength and to pre-

Here's How Blackhawk Socket Wrenches
SAVE 2 HOURS A DAY on this Job


BEFORE — (above) A rigid wrench must be repeatedly lifted off the nut and repositioned.
NOW — (below) a modern Blackhawk Ratchet permits the socket to be kept on until the nut is fully tightened. This 1" drive ratchet has 28 teeth for short powerful bites.

BLACKHAWK'S EXCLUSIVE COMBINATION OF FEATURES SAVE YOU TIME AND MONEY

ONLY Blackhawk Wrenches combine all these features — sturdy, thin walls that let sockets squeeze into tight spots — clean, hot broached sockets for long life and less nut wear — patented thumb release Lock-On for *extra* safety — all the drives to serve the complete range of socket sizes — and a complete assortment of handles and accessories that build up into scores of combinations for *extra* utility. Ask your Blackhawk Industrial Supply Salesman for a Blackhawk wrench catalog — or write us.

A Product of **BLACKHAWK MFG. CO., Dept. W2726 Milwaukee 1, Wis.**

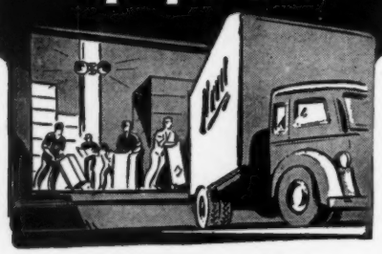
PATENTED "LOCK-ON" Saves Time, Temper & Machinery

A Blackhawk Socket and handle go together with a "click" that says they're really locked to stay — no danger of socket sticking in tight places or dropping off accidentally. Then, to disengage, the user just presses the "thumb release" button and pulls the combination apart.

Always Specify

BLACKHAWK SOCKET WRENCHES

Bogen
SOUND and COMMUNO-PHONE Equipment



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This Kelly Field, Texas, unit is one of the finest installations in the country. Controls 10 remote Administrative Centers, each with multi-station sub-master control of speakers in sub - sections. Sound - casts to 157 areas; two-way talk to 10 master sub-stations or any unit in system. Includes radio, phono.

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vent new lines of economic policy being pursued. The outcome of the present trial is as serious to our national welfare and to the development of world policy as the disposition of atomic power. Unless we can break sufficiently with the past to develop new policies which will prevent wide business fluctuations, we shall both injure ourselves and the cause of world peace. . .

Management has reacted variously to this program. Thousands of employers in numerous industries acted favorably and voluntarily granted increases. The overwhelming number of them neither asked nor secured price increases. Unfortunately a number of leading American corporations in the semi-monopolistic industries have chosen this occasion to challenge organized labor; resist reconversion at present price levels; and curb this general wage movement. They refuse to share the responsibility of evolving a progressive balanced economy. Reassured by their own financial powers of resistance, reinforced by favorable tax laws and their opportunities for sabotaging reconversion without easy public discernment, they have precipitated this conflict, hoping thereby to weaken unions, and gain price increases.

Wages and Business Cycles

The importance of the present conflict in the field of economic policy lies in the desire to introduce a new course in wage-price relationships. The customary sequence in this country has been for wages to rise toward the end of a business upswing and for wages to drop early in a business recession. This pattern has been repeated for more than a century. The first break occurred during the NRA. The wage increases were hastened and granted early in the business expansion and in some few instances in anticipation of the rise in business. The second important event occurred in 1938 when wage reductions were generally stopped in the face of a depression and price reductions. At present wage increases are being secured prior to the realization of the expanded civilian business because of the generous price margins, the anticipated high volume of business, and the recognition of the soundness of this course to sustain business prosperity. . .

Further support for this policy is derived from our experience that higher wages will support a higher volume demand for goods and thereby reduce costs. A significant fact observed during the war is that profits expanded despite declining unit profit margins. Peak volume can do more to

4 men
CAN ASSEMBLE THIS

in 10 hours!

Quick assembly is one important advantage of standard ARMCO STEELOX buildings. For example, once the foundation is in, an inexperienced crew of four men can assemble a 12' x 24' building in 10 hours. And because ARMCO STEELOX buildings are "portable," they can be moved from one location to another in less than a day! STEELOX panels can be salvaged 100% and reused many times.

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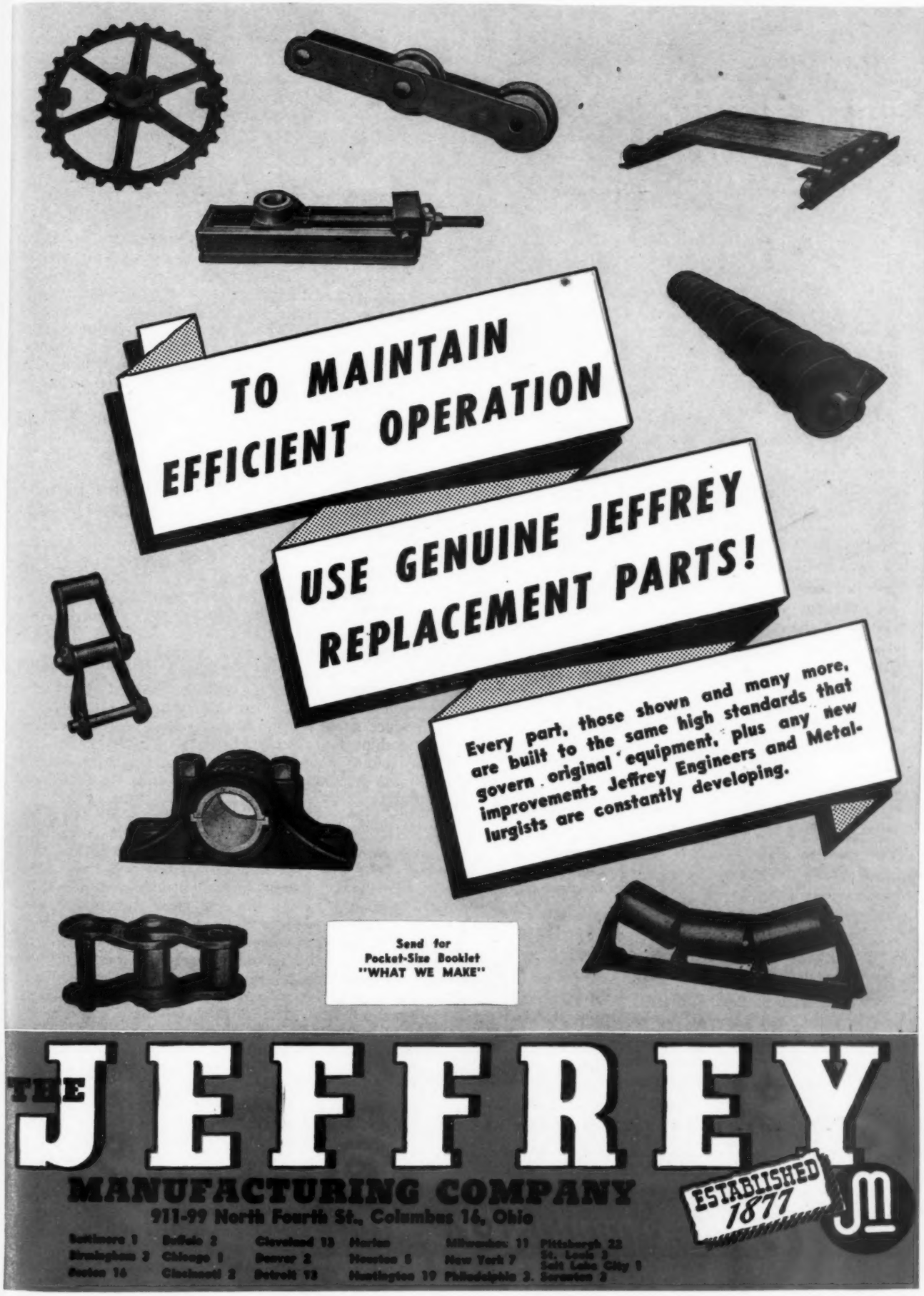
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reduce costs than any other factor of cost. High consumer demand must be sustained to replace the volume provided by the government's expenditures. An investment by industry in high wages must be the cornerstone of a post-war wage-price policy.

Selling America Short

Companies which are challenging labor's program are selling America short. They are planning on a severe contraction in demand. They are calculating costs on low operating rates and therefore fear high wages as part of such low operating conditions. . .

The principal determinant of cost and profits in most American industries is not really labor cost, but volume. The major consideration must therefore be the maintenance of a ready purchasing power to insure volume. Capacity operation reduces costs and increases the ability to pay wages. High returns to management are assured and all at lower prices for the consumer. It is the only sound principle on which our economy can be operated. The present controversy on wages has projected to the fore the issue of the rate of operations. High operating rates must be the basis for all calculations; there is no risk in making this assumption. . .

High Wages and High Production

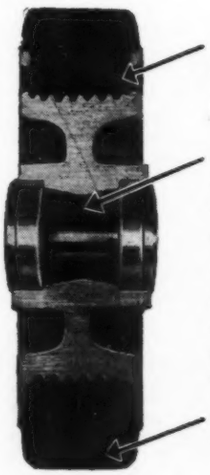
High wages reduce cost by providing the basis for volume operations. They permit the easy transference of custom-made articles to mass production basis, and its attendant reductions in cost. They permit the diffusion of cost over a large volume of items.

Our belief in the ability of industry to absorb these costs is strengthened by the impending increases in productivity. Reconversion will mean higher man-hour output in all industries. During the war great strides were made despite the use of the less efficient workers; high labor turnover; new methods; changing products; long hours; insecure living conditions; and unfavorable personal circumstances. The reversal of these conditions, if accompanied by adequate wages and security, will immediately be reflected in higher man-hour output. The 40-hour worker is always more productive than the 50- and 60-hour worker. The stable worker in his prime is a better producer than those previously employed. The satisfied worker always outdoes the disgruntled one who is not adequately fed or who is distraught by poverty. The return of peace means the continuance of improvements made during the war, the introduction of new ideas and equipment and the reorganization of plants,

Heaving decks and hastily laid, perforated landing mats were tearing to pieces the tail-wheels of Navy fighters and bombers. Flight operations were being retarded. Tremendous stocks of spares had to be maintained. Thousands of man-hours and plane-hours were being lost because tail-wheel replacements had to be made after a few landings.

Needed—*rush!*—a tail-wheel that could stand up against terrific impact, heavy loads, knife-sharp edges and abrasive surfaces. The Navy enlisted the services and rubber know-how of Thermoid-Grizzly. The Tread-Lock Tail-Wheel developed by Thermoid-Grizzly solved the problem, outlasted previous types of tail-wheels *literally 100-to-1.*

The same, tough, war-proven Tread-Lock Wheel, adapted for industrial use, is now available for new equipment and for replacements. For further information, write for the folder "Industrial Wheels". Thermoid-Grizzly Wheel Sales, Chicago, Ill.



Patented "Breather" Holes in the casting allow the rubber to expand under pressure and contract when the pressure is removed.

Patented Lifetime Self-Lubrication System. Hour-glass design forces grease centrifugally to the sealed, precision-built bearings, which are lubricated for life.

Variety of Sizes. Standard sizes are 6", 8", 10" and 12". Special sizes can be made to order. Fit all standard size axles.

Cut-Resistant Tread stays true, easy to push or pull. Silent.

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LIGHT ANGLES
PIPE
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SOFT STEEL
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TUBING
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STAR metal cutting book tells the proper selection, care and use of Hand and Power Hack Saw Blades and Flexible Back Band Saws for the materials to be cut. Send for FREE copies.

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layouts, methods and machines. It is probably conservative merely to quote the forecasts of the Bureau of Labor Statistics that we can expect at least a repetition of the experience of the last war, a 10 percent per annum increase in productivity.

Moreover, wage increases provide constructive stimulation not only to individual plant economies but to improvements in the organization of industries. They have frequently led to the reorganization of the relationships within an industry so that wasteful duplication of services is eliminated and excessive handling of products is reduced. These structural changes portend sizable long term savings. Possibly it may produce these savings in distribution costs which we seek.

Freely granted and negotiated wages can also serve as a basis for improved labor relations and the foundation for labor-management cooperation. During the war labor-management committees have produced great savings. With constructive industrial relations they can be continued profitably during the peace.

Costs in industry are not fixed. Only a dynamic conception of the ever-changing relationships within industry can furnish us a clue to the ability of industry to pay. Management has always proved itself to be resilient and resourceful. It provides the faith on which we base our expectations for ever-rising standards of living. The denial of wage increases at this juncture is merely a confession of an individual employer that he no longer believes in the very system of progressive enterprise which he urges.

Further, high wages produce a stable work force. Labor turnover costs, including training and other well-known elements chargeable to labor turnover, have been extremely high. Any move to reduce this cost through the greater satisfaction of high wages will result in lower labor costs in the long run.

There are two additional considerations which support our requests for wage increases. They have been pointed out on numerous occasions and are measurable. In the first place, there are the direct labor savings due to the reduction in overtime pay, high vacation pay, downgrading, and the elimination or contraction of incentive wage yields. In the second place, there are the generous margins contained in the present price structure which produced profits of $25,000,000,000 in 1944 for corporate and $24,000,000,000 for unincorporated business.

These facts certainly support the proposed wage increases. An impressive number have already granted these

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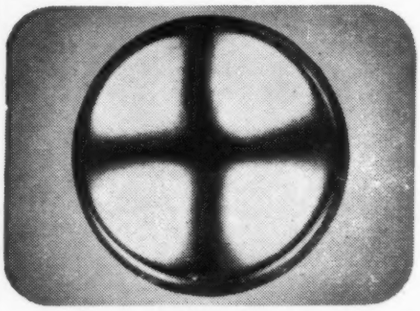
• Accurate fit for every worker—whatever his type of face—is easily possible with Willson's 20 sizes. Remember, correct fit is necessary for maximum safety. For day-long comfort, too.



• SUPER-TOUGH* lenses ward off impact hazards. Each lens is thoroughly tested. Examples: Polariscope test for uniformity of heat treatment; Federal drop-ball test for impact resistance.

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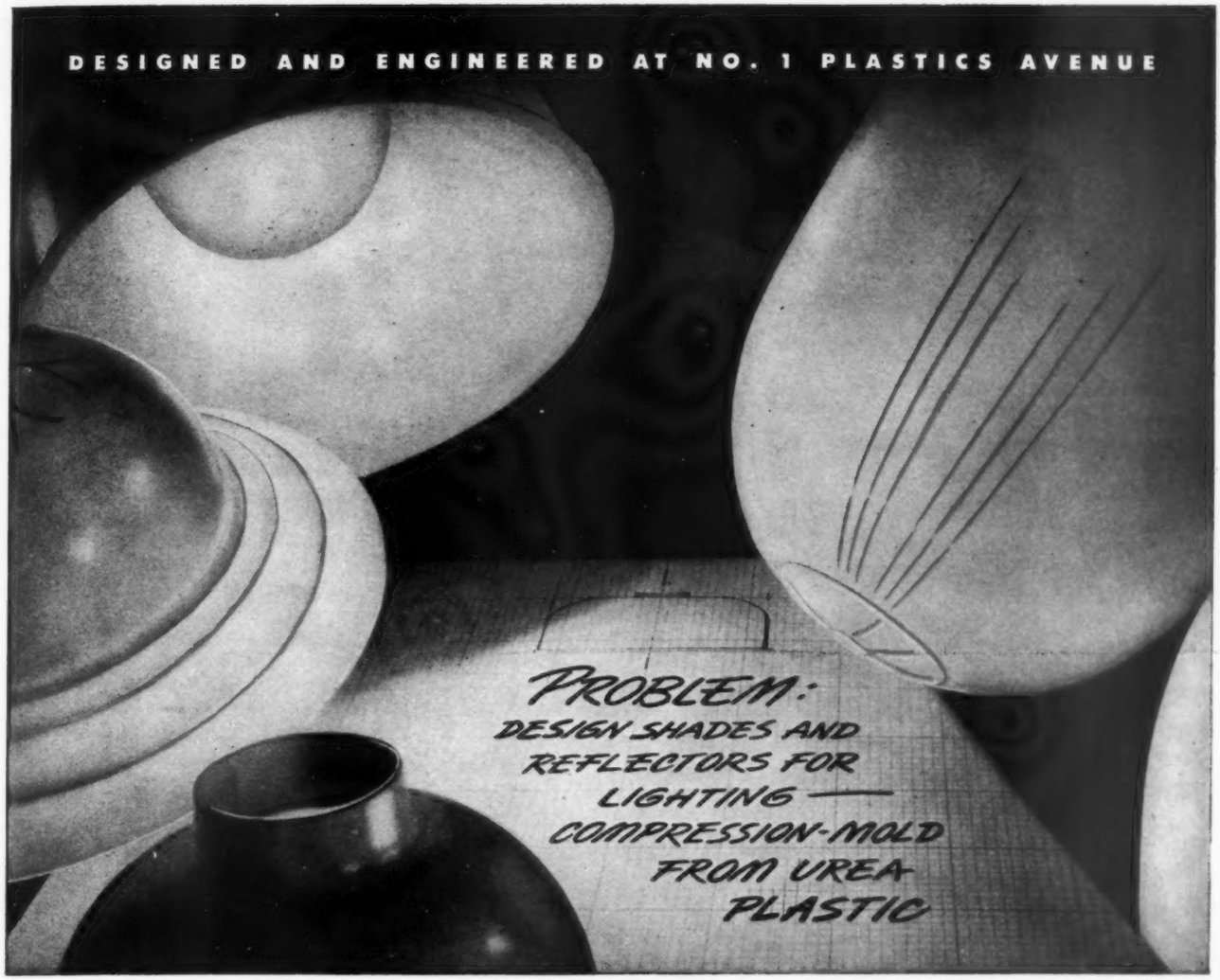

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These famous tools are better than ever . . . embodying the experience gained since 1897 PLUS the lessons learned "the hard way" during the war years.

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Model 10, for 12" to 20" wheels. Heavy duty ball bearings, enclosed in dustproof boxes, support heavy one-piece, alloy steel spindle. Push button control with overload protection. Semi-steel wheel guards are hinged door type. ADJUSTABLE TO WHEEL WEAR. High-grade chrome - manganese alloy steel spindle is provided with positive shaft-locking device for holding shaft while renewing wheels. Heavy-duty motors.

Standard equipment includes adjustable tool rests, eye shields, straight flanges, water pot and tool tray on 2 h.p. and 3 h.p.

LOOK TO UNITED STATES ELECTRICAL TOOLS TO HELP YOU CUT COSTS AND INCREASE PRODUCTION IN '46

The **UNITED STATES ELECTRICAL TOOL Co.**
CINCINNATI, OHIO

increases without asking for price relief. The real concern is that the wage increase will not be sufficiently large to change markedly the proportion of labor income to the total national income. The offsetting considerations of lower unit costs through large volume, higher productivity, and reduced operating costs, may permit management to effect the increase and maintain its high profits and proportion of the total national income.

We must increase the relative as well as the absolute proportion of labor income in the total national income in order to balance our economy. The 62 percent which wages and salaries constituted of the national income must be measurably expanded to reduce the gap in our national economic budget between income on the one hand and expenditures and investment on the other. The insistence on the maintenance of prices with a concurrent increase in wages may effect an increase in the relative proportion of the national income received by labor. We must advance toward this goal through collective bargaining so that we shall not have to resort to governmental expenditures to supplement incomes or industrial enterprise. We cannot move fast enough in our efforts to complete the present wage movement and maintain the buying power of the American people.

Condemnation Undeserved

Instead of condemning labor organizations for initiating this present wage movement, organized labor deserves the approval of all forward-looking Americans. No other group has come forward with a sound base for a post-war free economy or a program more in consonance with the national interest. If anything, we must begin thinking of the next movement for additional wage increases and inaugurate it at the earliest possible moment. Instead of compromising with the present proposals we must consider them most conservative since a full balance of our economy requires a much more stupendous rise in earnings. Some have even considered a 50 percent increase in buying power as a proper measure of the job which is ahead of us in order to attain a full balance through the wage bill.

The demands of a progressive expanding stable economy are pressing. We cannot delay them for long. Any continuance of the prevailing maldistribution of income brings earlier the day of our economic debacle and extreme governmental intervention. The time we buy depends upon the success of the wage movements in righting

Bronze Valves with a Pedigree

The Powell Line of Bronze Valves for controlling intermediate steam, oil, water and gas is not an overnight development. Rather, it is a result of evolution through Powell's 100 years of practical, scientific progress in the art of valve-making.

Starting in the first generation with the celebrated "Star" Regrinding Globe Valve, invented and patented by James Powell, each succeeding generation of the Line has produced better and better valves. Today the nation-wide performance of Powell Bronze Valves definitely stamps them as "Valves with a Pedigree."

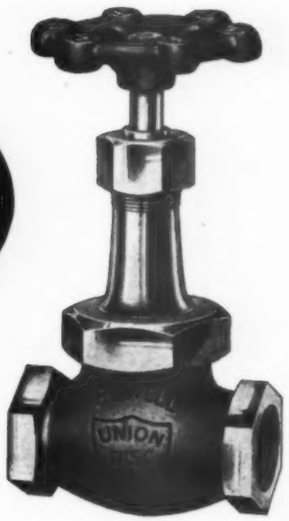

Fig. 150

Fig. 375

Fig. 1708

Fig. 1414

Fig. 500

Fig. 1414—125-pound Bronze O. S. & Y. Gate Valve with flanged ends.

Fig. 500—125-pound Bronze Gate Valve with screwed ends, inside screw rising stem and screwed bonnet.

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, inside screw rising stem, union bonnet, renewable seat and regrindable, renewable wear resisting semi-cone plug type disc.

Fig. 375—200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable wear resisting seat rings and disc.

Fig. 150—150-pound Bronze Globe Valve with screwed ends, union bonnet and renewable composition disc.

The Wm. Powell Co., Cincinnati 22, Ohio

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GENERAL ELECTRIC
Water Coolers

the gap in our economy between income and expenditures and investment. Management should join with labor in this program of rising wages and controlled prices to promote an expanding stable free economy.

Charting Relation of Volume and Costs

C. C. BALDERSTON, Dean, Wharton School of Finance and Commerce

Cost reduction is one of the most venerable of topics, at least among men of affairs. More efficient use of resources, plant, and labor is important at all times. Otherwise the scale of living is not raised as rapidly as it might be. Attention to cost reduction is imperative if the ravages of war are to be repaired quickly and goods and services produced to minimize the existing hunger and suffering.

The need now is for a return at once to the most efficient production which workers and executives, laboring with good will, good sense, and good management, can continue to give a suffering humanity. The more significant cost factors must be separated from the less so that the main attention of management may be directed toward those functions whose critical appraisal would yield the largest returns.

What is not always recognized clearly is the impact of each cost factor upon management activities. For example, a high percentage of labor cost makes labor relations and wage administration of critical importance. Obviously the lower the percentage of labor cost, the more easily can a company provide the expensive portions of an industrial relations program. A retirement plan costing 10 percent of payroll, or an extra week of vacation with pay costing 2 percent of payroll, will be more or less burdensome depending upon this fundamental difference. Moreover a high percentage of labor cost, if accompanied by the necessary volume, is an invitation to mechanize. And it is in such situations that wage-price relationships are all important.

Similarly one might trace the impact of high raw material costs, like those found in meat packing, upon the need for effective purchasing and inventory control. Not only will management place its procurement in strong hands, but it will also install the necessary facilities to safeguard its inventories against deterioration, waste, and shrinkages in either physical quantities or in dollars.

It is when we come to fixed overhead that we encounter the most interesting questions of policy. The larger the fixed overhead, the more necessary become sales volume and a high

SPEED UP SCREW DRIVING

and other Production Jobs!

Give every worker the *right* tool for the job—and you'll see efficiency go UP and costs go down!

In screw driving operations, for example, you can get *top-speed* production with *less fatigue* by using ARO Pneumatic Screw Drivers selected especially for a specific job. ARO builds 'em *right* for accurate, rapid, trouble-free performance in a broad range of capacities. Each tool small in size and light in weight in relation to its big power. The ARO line also includes precision-built tools for such specialized operations as drilling, nut-setting, grinding, and countless other production jobs. Write for catalog. The Aro Equipment Corp., Bryan, Ohio.

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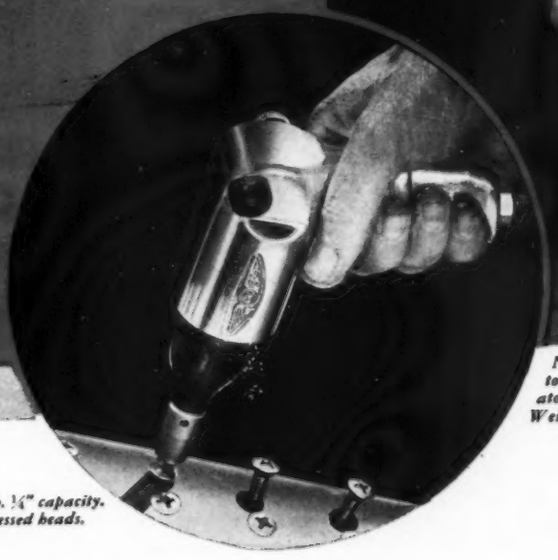
NEW Aro Model 7000 — "cigar size", weighs only 8 oz.; 4-1/8" long, 3/4" diameter. Capacity No. 1 to No. 6 screws. Fully automatic —no manual throttle. Starts automatically when pressure is applied.

NEW Aro Model 3020—capacity No. 4 to No. 10 screws. Adjustable clutch. Operator selects speed up to 2500 R. P. M. Weight only 1¾ lb. Overall length 8".

Model 22PAH Pistol Grip Screw Driver with adjustable clutch. Capacity ¼".



Model 106 Impact Wrench. ¼" capacity. Reversible. Ideal for recessed heads.

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Here is *real* transportation insurance! Protect drivers, passengers, goods in transit, with this unequaled safeguard. "FOG KINGS" are in wide use on trucks, busses, and commercial airlines as well as passengers cars. New features have special appeal: Chrome or bakelite finish. Rust-proof. Anti-vibration saddle mounting. Theft-proof skirting covering bolthead, etc.

"ROAD KING" Auxiliary Driving Lights are also furnished with Westinghouse Sealed Beam units — or in Reflector Type.

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Electrically operated. Furnished with or without checking tables. Speeds up freight movement. Less manpower required for loading and shipping. Portable types. Stationary types. Sturdy construction. Designed by engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

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unit contribution to fixed overhead and profit.

For clarity of thinking, the profit objective of the company must recognize the close identity of fixed overhead and profit. Until the first is covered there is no profit. And so instead of loose talk about profit by lines, management should compute the contribution to fixed overhead and profit of its items and lines. By contribution is meant the difference between selling price and variable cost.

Cost of Distribution

One must not close a discussion of cost significance without reference to distribution costs, because of the ultimate cost of a product to the consumer, over one-half is marketing expense.

The relative advantage of advertising and salesmen must be considered. One need comment only that management research is less fully developed in this area than in production, and that distribution accounting is not always an adequate guide to the making of decisions. Cost items that are significant are not always controllable. Some are like sponges squeezed dry; others are still full of water and need only to be squeezed to yield copious savings.

There is no substitute for placing in each key position an individual whose ability and training match its requirements. Given such an executive with an observant eye for waste and the determination to eliminate it, reduction of costs is well started.

Executives know that both operating standards and output standards are necessary. Standards are the base line of management. They should represent the fruit of research and as far as that research yields better products, materials, tools, and methods, it is a cost reducer. At least the research will reveal how savings are to be made, and the operating standards will provide the basis for controls that will bring them about. These operating standards in turn permit the establishment of output standards which are the yardsticks by which to measure performance. Standards of both types are the first step in control, because they indicate what ought to happen and thus make wastes apparent for all to see. They facilitate planning as well, because they permit reliable predictions to be made concerning the behavior of items that have been standardized.

Standards thus make possible the whole series of aids to control that reduce waste—reports of worker efficiency, reports of material usage, reports of machine loads and of unabsorbed factory burden, reports of sales volume and selling expenses, and the

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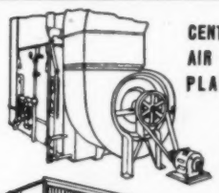
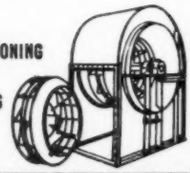
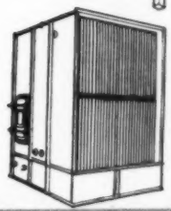


CENTRAL STATION AIR CONDITIONING PLANTS



AIR CONDITIONING AND VENTILATING FANS



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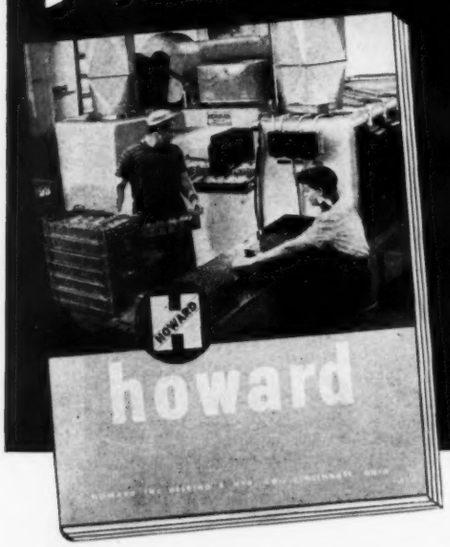

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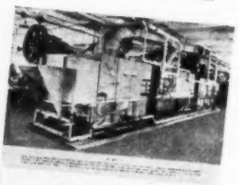

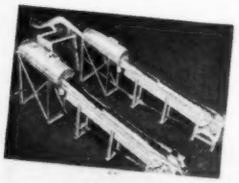

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coordinated budget for the enterprise as a whole.

What is less clearly understood is the problem of reducing cost without disturbing the balance of the company's operations. The intricate relations between volume, income, and costs need clear portrayal if efforts to reduce cost are not to injure the company as a whole.

The relationships to which we refer are customarily pictured by a breakeven chart, which is without doubt the most revealing single business record that an executive may study. It is a graphic picture of the relation of a company's income and outgo to its volume. It reveals how much a saving in material, labor, or fixed overhead would add to profit, the extent to which such savings are a substitute for volume, the relative advantage of seeking cost decrease as against volume increase, and how much additional volume would be required to offset a certain reduction in unit price. This over-all approach enables the management to begin a comprehensive survey of cost reduction possibilities with a definite profit objective in mind. The breakeven chart makes clear that to achieve a given profit in dollars, a certain combination of volume, unit price, and unit cost must be achieved.

The breakeven chart has by now given birth to several offspring, some more helpful than others. All show their kinship to the parent by indicating the impact of changing volume. There are charts showing the relation of profit (or loss) to volumes above and below the breakeven point for the company; charts showing how the contribution to fixed overhead and profit varies with volume; charts showing how this contribution is affected by changes in selling price or variable cost; charts showing how the breakeven point is influenced by changes in fixed expense, selling prices, and variable costs; and finally the familiar charts relating to volume each item of variable or semi-variable cost.

Without such a comprehensive analysis, using a breakeven chart and its auxiliaries, a top management can scarcely hope to direct its cost reduction campaign with intelligence.

•

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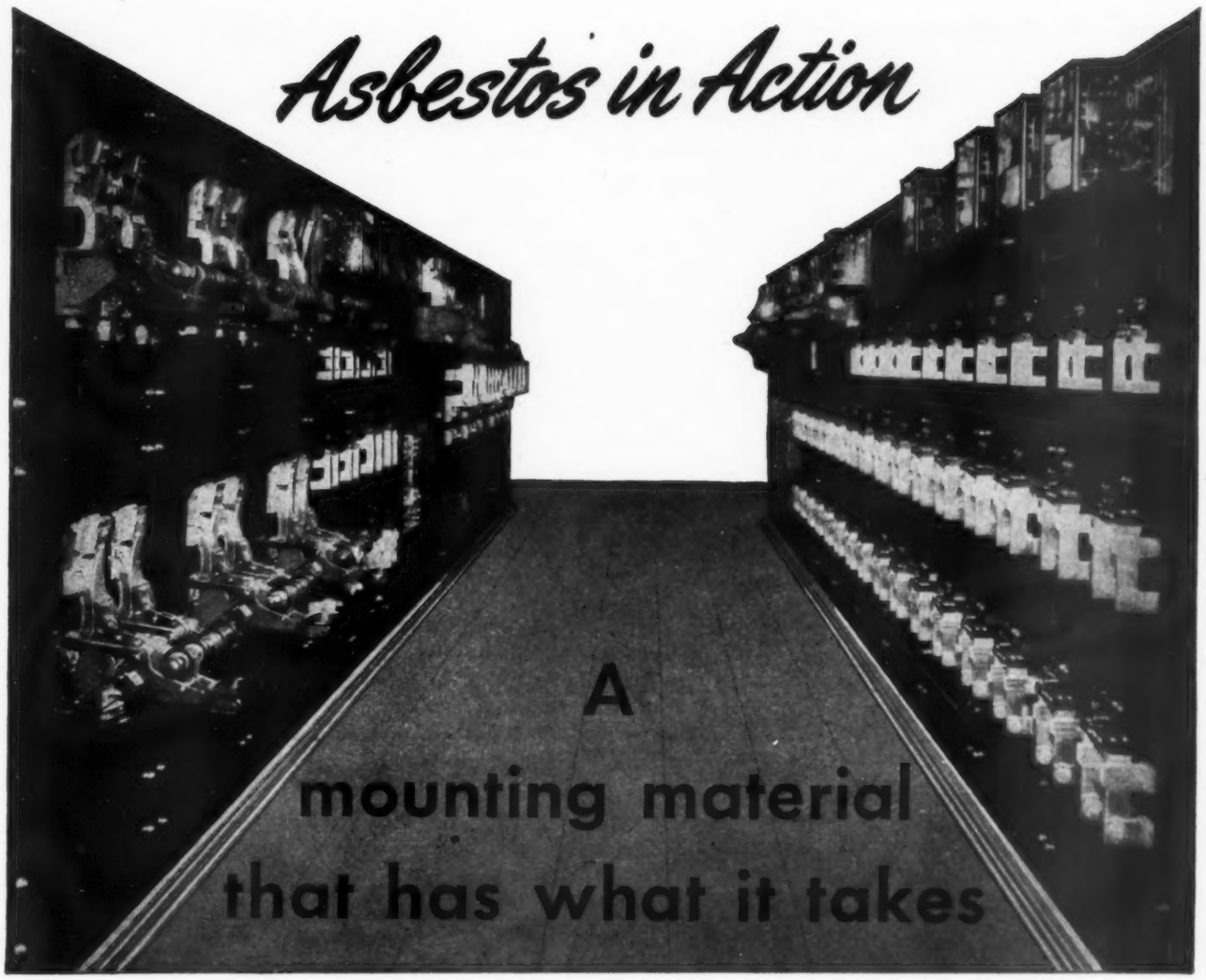
From McGraw-Hill News Bureau, London

Recognizing a deficiency in the number of trained engineers capable of rising to executive positions in chemical, mechanical, and electrical industries, and pointing clearly to shortcomings



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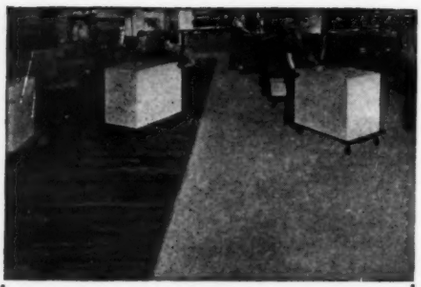
of the present system of higher education, a committee of British educators and industrial executives has recommended considerable revision and extension of the engineering courses offered by some 150 technical schools and colleges to supplement the output of the 13 university-type colleges now empowered to grant degress in engineering, and thus arrive at a goal of about 3000 yearly graduates capable of becoming industrial administrators, development engineers, designers, managers, production experts, and technical salesmen. Pre-war output probably did not exceed 2300 men in all classifications of science and engineering, and the emphasis among these men tended toward development of scientists rather than men who might fit more readily into industrial management.

Technological Courses

Committee recommendation envisages the selection of a strictly limited number of technical colleges in which are to be developed technological curriculums of a standard comparable with university degree courses. Regional advisory councils should be established to coordinate technological studies in universities and technical colleges toward a greater freedom of transfer of undergraduates from technical colleges to universities, and a mutual interchange at the post-graduate stage. A further responsibility would be establishment of a few centers of education specializing in certain limited fields such as horology, scientific instruments, and rubber technology.

A triple-barreled blast at conventional British higher education is contained in the committee's concluding recommendations that (1) *all* students of technology should have introductory courses, at least, in what may conveniently be called "management" studies; (2) at least *one* institution should be selected as a center for post-graduate study of industrial administration; and (3) management studies should form a part of the courses not only of universities and colleges of technology, but also of *all* technical colleges teaching for national certificates and diplomas. Further singled out for special attention is the systematization of short or refresher courses in management to be organized by joint effort of the teaching profession and industrial specialists. It is even suggested that teachers undertake study in refresher courses to keep up with advancements in science and technology with lecturers recruited from practicing specialists of industry, or, alternately, return to industry for substantial periods.



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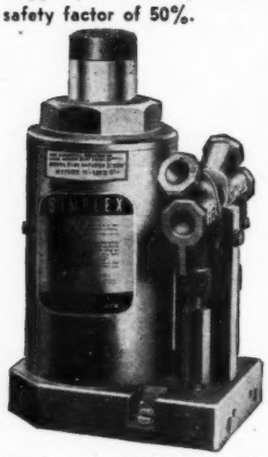

Simplex No. 50HJ Hydraulic Jack, capacity 50 tons. Hydraulic lift 7". Has two pumps —high and low speed—which can be operated singly or in unison. No. 30HJ, same design, capacity 30 tons. Also made in 3, 5, 8, 12 and 20-ton capacities.

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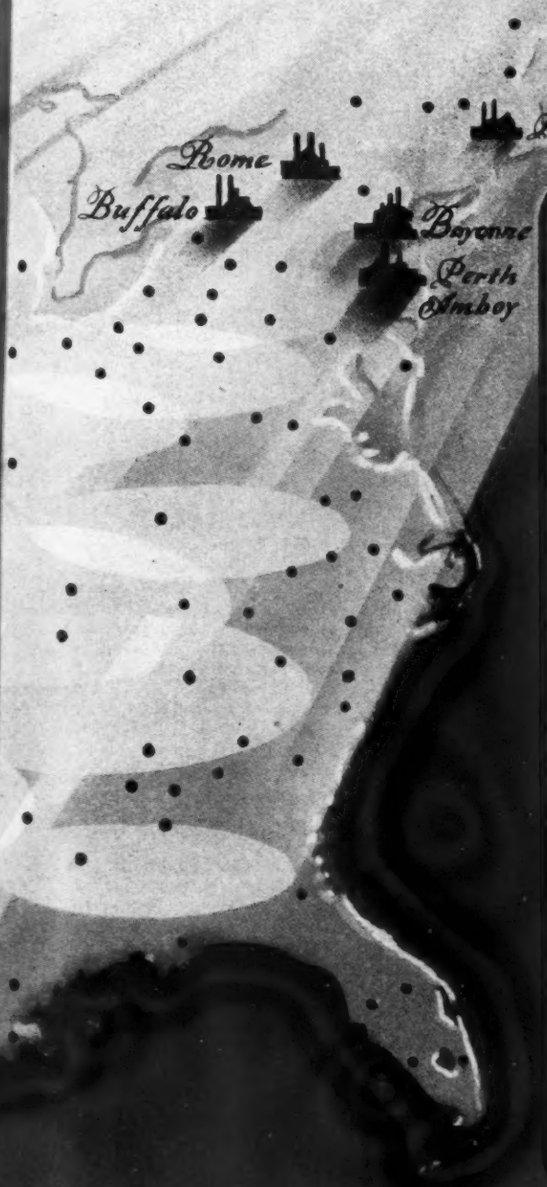

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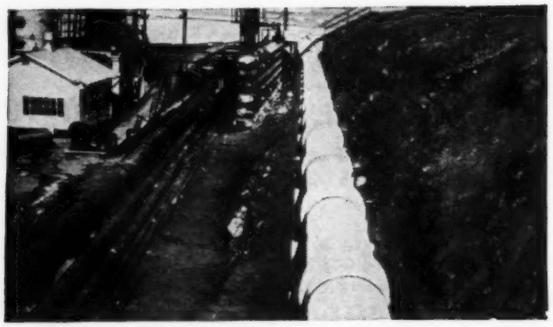

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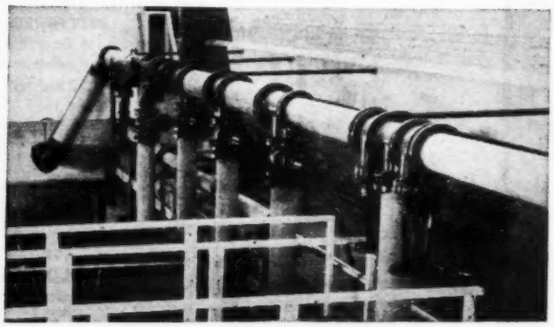

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BOOKS

BASIC ELECTRICAL ENGINEERNG

A. E. Fitzgerald, Sc. D., Associate Professor of Electrical Engineering, Massachusetts Institute of Technology. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 443 pages. Photographs, figures, drawings, index. $3.75.

Written to fill need for revaluation and revision of courses in electrical engineering given to students majoring in other engineering and scientific fields. Covers basic principles in fields of circuit theory, machines, electronics, a foundation for more specialized techniques to be developed later. Emphasis placed on engineering applications and economic implications of the three fields covered.

THE TRAINING WITHIN INDUSTRY REPORT, 1940-1945

War Manpower Commission, Bureau of Training, Training Within Industry Service, Washington, D. C. 330 pages. Sample reports, charts, schedules, appendix. 50c.

Subtitled: "A Record of the Development of Management Techniques for Improvement of Supervision—Their Use and the Results." This is a report of Training Within Industry activities during the war period. In two parts, the first is an account of the organization, how it worked, mistakes it made, and results accomplished. A technical section describes the development of the TWI program and techniques, with sample exhibits to illustrate methods of procedure.

THE WAGNER ACT: AFTER TEN YEARS

Edited by Louis G. Silverberg, Director of Information, National Labor Relations Board. Bureau of National Affairs, Inc., 24th & N Sts., N. W., Washington, D. C. 126 pages. Cartoons, photographs. $2.

Commentary by 11 nationally known figures on the law's foundation, its early struggles, its impact on workers and management, plus an analysis of strengths and weaknesses from the point of view of observers both favorably and unfavorably inclined toward the law. Contributors include Charles Fay, Lee H. Hill, Paul R. Hutchings, Leon H. Keyserling, William Leiserson, Judge J. Warren Madden, Dr. H. A. Millis, Joseph Rosenfarb, Malcolm Ross, Louis G. Silverberg, and Sen. Robert F. Wagner.

TRENDS IN COLLECTIVE BARGAINING

S. T. Williamson and Herbert Harris, with report and recommendations by Labor Committee of The Twentieth Century Fund. The Twentieth Century Fund, 330 West 42nd St., New York 18. 254 pages. Index. $2.

A report, subtitled "A Summary of Recent Experience," based on a long-term investigation of policies and practices in collective bargaining. Particular attention is paid to the attitude and reaction of both labor and management to technical progress.

ELECTRIC CIRCUITS AND MACHINES

Eugene C. Lister, Electrical Engineer, Stanley Engineering Co. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 358 pages. Wiring diagrams, symbols, tables, photographs, appendix, index. $3.50.

Subtitled "An Introduction to Practical Electricity." An elementary text covering funda-

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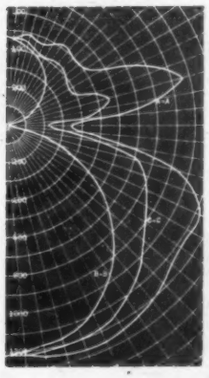

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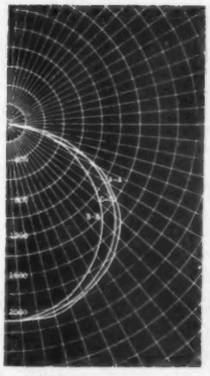

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mentals of direct and alternating current circuits and machines. Basic principles and physical action are emphasized. Appendix includes wiring diagram symbols, tables for solid and stranded wire, and for full-load currents of motors, as well as trigonometric definitions and formulas with a table of trigonometric functions.

WHEN FOREMAN AND STEWARD BARGAIN

Glenn Gardiner, Vice-President, Forstmann Woolen Co. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 194 pages. $2.

One of the "Industrial Organization and Management Series." Discussion of the latest developments in union relations, stressing the importance of the relationship between foreman and union stewards as one of the critical stages of collective bargaining. Suggests methods of handling grievances and techniques to be used in maintaining good human relations in a unionized shop through constructive teamwork between foreman and steward.

THE PRACTICAL DESIGN OF WELDED STEEL STRUCTURES

H. M. Priest. American Welding Society, 33 West 39th St., New York 18. 150 pages. $1.

Explains general and detail design considerations for simple welded joints and connections, and their application to typical structural members. Weld geometry and stress concentration, temperature effects, both physical and metallurgical, welding processes and positions, specifications for electrodes, and qualification tests and inspection are discussed. Charts and tables illustrate the codes of the American Welding Society.

A PROGRAM FOR PERSONNEL ADMINISTRATION

J. J. Evans, Jr., General Personnel Manager, Armstrong Cork Co. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 100 pages. Index. $1.50.

One of the "Industrial Organization and Management Series." Sets forth the steps involved in planning and putting into practice an effective personnel administration program, qualifications of a successful personnel administrator, and analyses the relation of personnel relations to production problems. A chapter on contractual labor relations discusses the effect of the well-functioning personnel officer on labor-management understanding and cooperation.

PLANNING FOR JOBS

Edited by Lyle Fitch and Horace Taylor, Department of Economics, Columbia University. The Blakiston Co., 1012 Walnut St., Philadelphia. 463 pages. Bibliography, index. $3.75.

A study of proposals and suggestions based on nearly 36,000 entries submitted in a contest for The Pabst Post-War Employment Awards. Selections were made with a view to representing the principal trends of public thinking on various aspects of the employment problem.

SEQUENTIAL ANALYSIS OF STATISTICAL DATA: APPLICATIONS

Prepared by Statistical Research Group of Columbia University, for Applied Mathematics Panel, National Defense Research Committee, Office of Scientific Research and Development. Columbia University Press, 2960 Broadway, New York 27. Charts, graphs, tables, appendixes. $6.25.

Report, in six sections, follows an original study of the theory of sequential analysis, and deals with its use in dealing with elaborate statistical problems. First used in development

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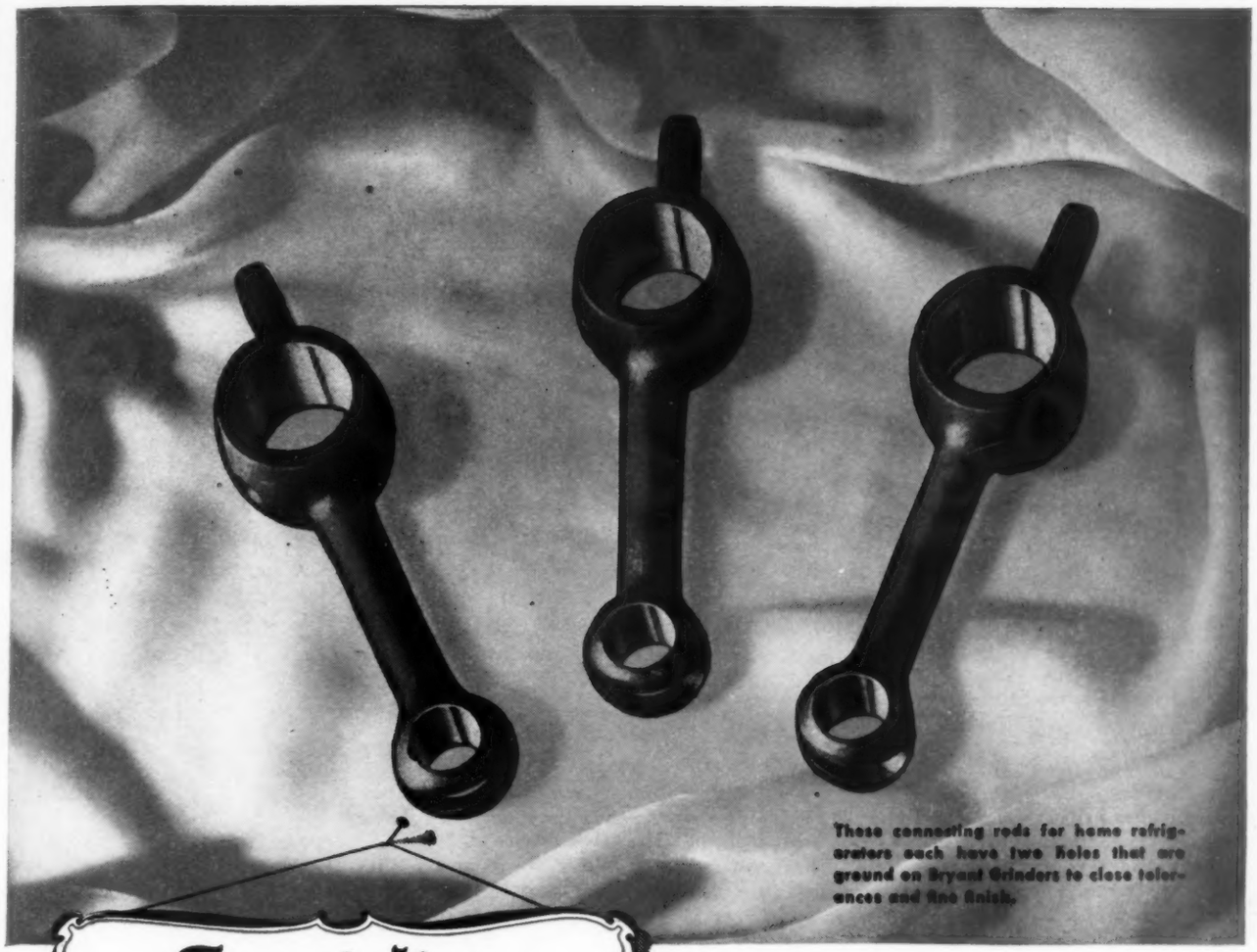


These connecting rods for home refrigerators each have two holes that are ground on Bryant Grinders to close tolerances and fine finish.

Specialists in Forged Steel Jewelry

No, we don't sell it; we don't make it, but we do build internal grinding machines that make it. The three connecting rods for home refrigerators, shown above, are typical examples of the type of work that is ground on Bryant Internal Grinders. They are truly jewel-like in their finish, but that is not enough—to be sure, Bryant Grinders produce metal parts that have surfaces finished correctly to millionths of an inch, when desired, but Bryant machines also produce these same parts with holes that are truly round and straight. These are basic elements that Bryant insists upon to assure Bryant users that their parts and products will last for years without mechanical failure.

WE KNOW YOUR PROBLEM IS DIFFERENT . . .

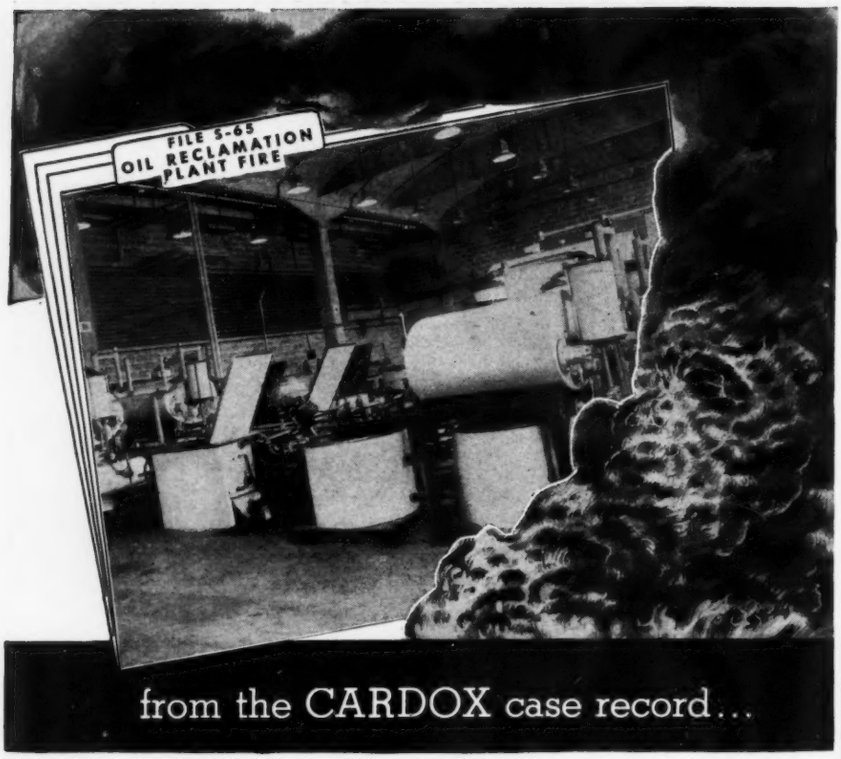
. . . practically every internal grinding problem is different. But when you require extreme accuracy or high production, or *both*, your first step should be to study your problem with a man who makes it his business to solve them. Your first step should be to—

Send for the Man from Bryant!

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.



from the CARDOX case record...

Out of actual on-the-job fire experience comes evidence that Cardox Fire Extinguishing Systems provide a scope of carbon dioxide performance... and standard of effectiveness . . . far beyond the generally recognized advantages of this fast acting, non-damaging, economical extinguishing medium.

File No. S-65, covering an investigator's report on Cardox extinguishment of an oil reclamation plant fire, offers an interesting example of Cardox protection by total flooding . . . one of the many types of protection made most effective by Cardox methods of controlling and applying carbon dioxide:

"Officials of the company were highly pleased with the speed and effectiveness of the Cardox System in extinguishing a fire in the company's big *Oil Reclamation Room*—one of nine rooms and a long pipe tunnel protected by this Cardox System.

"The fire was caused by the overheating of a refining unit, causing the oil to boil over. This oil, which has a 450° F. flash point, was estimated to be at 550° F. when it boiled over. It immediately burst into flame, creating a large, hot fire.

"However, the thermostat immediately actuated the Cardox System. Approximately 5½ tons of Cardox CO_2 were released . . . instantly extinguishing the fire, and totally flooding the room with carbon dioxide. The only evidence of the fire was the paint burned off the refining unit in which the blaze originated. Normal operations were resumed in less than one hour."

The danger spots in your plant may not be similar to the one described in File S-65. But, if they involve flammable liquids, electrical equipment or hazardous manufacturing operations, Cardox offers a new scope of protection you should investigate. By increasing the performance effectiveness of carbon dioxide . . . by making it practicably available in a single system for use in *tons* for large fires or *pounds* for small ones, with ample reserve for new emergencies... Cardox has set new high standards of protection for many of the most severe hazards in American Industry.

An analysis of your fire hazards by Cardox Research Division and Engineering Staff puts you under no obligation. Write for Bulletin 336.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
District Offices In
New York, Philadelphia, Washington, Pittsburgh, Cleveland, Detroit, Cincinnati, Houston, San Francisco, Los Angeles, San Diego

CARDOX
CO_2 FIRE EXTINGUISHING SYSTEMS

work on military and naval equipment, analysis of combat experience, and similar problems of war research. New developments apply to practical applications in industry.

BOOKLETS

LABOUR LEGISLATION in Canada. A Historic Outline of the Principal Dominion and Provincial Labour Laws. Legislation Branch, Department of Labour of Canada, Ottawa. 33 pages. Tables, charts. No charge.

THE REFUGEES Are Now Americans. Maurice R. Davie and Samuel Koenig. Public Affairs Pamphlet No. 111. Public Affairs Committee, Inc., 30 Rockefeller Plaza, New York 20. Sketches, graphs, bibliography. 10c.

BUILDING A COST-MINDED ORGANIZATION. Restoring Cost Controls; The Foreman's Part; Making Workers Cost-Conscious; Top Management's View; The Union View. Production Series No. 160. American Management Association, 330 West 42nd St., New York 18. 39 pages. 75c.

INCENTIVES FOR MANAGEMENT AND WORKERS. Production Series No. 161. American Management Association, 330 West 42nd St., New York 18. 28 pages. 50c.

DEVELOPMENTS IN PRODUCTION AND MANAGEMENT ENGINEERING. Quality Control by Statistical Methods; Plant Layout and Materials Handling; Work Simplification. Production Series No. 162. American Management Association, 330 West 42nd St., New York 18. 44 pages. 75c.

TOP MANAGEMENT POLICIES AND PHILOSOPHY. General Management Series No. 133. American Management Association, 330 West 42nd St., New York 18. 35 pages. 75c.

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MANAGEMENT'S RESPONSIBILITY TOWARD STABILIZED EMPLOYMENT. General Management Series No. 135. American Management Association, 330 West 42nd St., New York 18. 23 pages. 50c.

101 WAYS TO BE YOUR OWN BOSS. Michael Gore. Arco Publishing Co., 480 Lexington Ave., New York 17. 127 pages. Charts, lists. Paper, $1; cloth, boards, $2.49.

LABOR SAVINGS IN AMERICAN INDUSTRY, 1899-1939. Solomon Fabricant. Occasional Paper 23. National Bureau of Economic Research, 1819 Broadway, New York 23. 52 pages. Tables. 50c.

NATIONAL COLLECTIVE BARGAINING POLICY. Industrial Relations Counselors, Inc., 1270 Sixth Avenue, New York 20. 103 pages. $1.25.

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ON THE CALENDAR

FEBRUARY

4–8, American Society for Metals, 27th National Metal Congress and Exposition, Cleveland Public Auditorium, Cleveland. W. H.

USE ADJUSTABLE PERFORATING DIES FOR INCREASED PRODUCTION

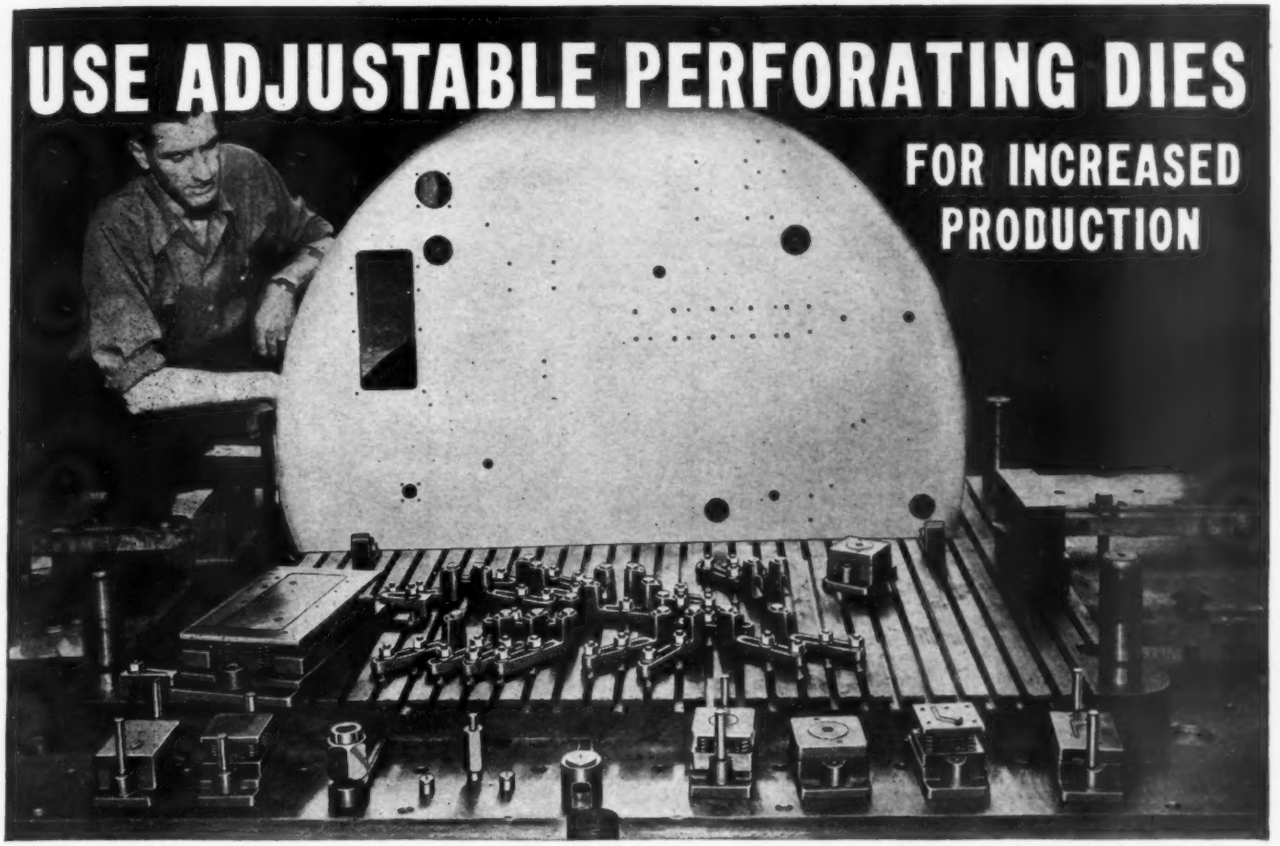
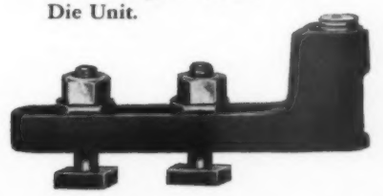


PHOTO COURTESY LOCKHEED AIRCRAFT CORPORATION

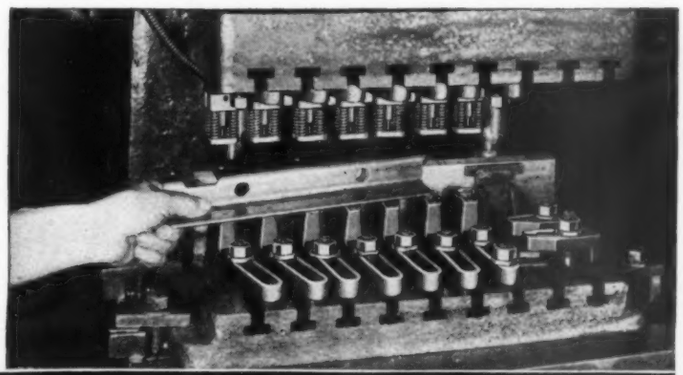
HERE IS TWO-FOLD MANUFACTURING ECONOMY

Whistler precision perforating dies get you into production quicker—make your own set-up in a matter of minutes as against weeks. Rearrange the same units—add or delete sizes or shapes—and get going on the next job. Original die cost is amortized over any number of jobs. Effect pre-production and production time savings that can only be measured by the size and importance of each job.

Complete assembly of Whistler Adjustable Perforating Punch and Die Unit.



Whistler Adjustable Perforating Dies are shipped from stock or within a few days, in sizes from 1/32" to 1½"—round, square, oval and rectangle—for perforating mild metals to ¼" thickness. Notching dies and special shapes made to order and can be used in combination with stock units. Whistler Adjustable Dies work on practically any type press. Close centers permit more perforations per press operation. Absolute precision on short or long runs. All parts are interchangeable. Write us today and ask for the Whistler Catalog.



S. B. WHISTLER & SONS, Inc.
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WHISTLER MULTI-USE ADJUSTABLE PERFORATING DIES

Talk About PRODUCTION Without DIES!

4,000 Parts Per Day with DI-ACRO Bender

Here is an example of "DIE-LESS DUPLICATING" typical of a great variety of formed parts readily made with DI-ACRO Precision Machines,—Benders, Brakes, Shears. Picture below shows an acute right angle bend and photograph above shows the finished part formed to die precision. Women operating DI-ACRO units maintain a high out-put on production work.

"Enclosed pictures in our plant prove the DI-ACRO Bender will do a real production job. We are making 4,000 completed parts per day which is competitive to most Power Presses." (Name on request)

DI-ACRO is pronounced "DIE-ACK-RO"

Send for CATALOG

showing DI-ACRO Precision Machines and many examples of parts made with "DIE-LESS DUPLICATING."

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CONTINENTAL "18"

TRADE MARK REG. U.S. PAT. OFF.

THE SUPER FLOOR FINISH

Clings to the Floor For Longer Wear

Vulcanized rubber forms a perfect bond . . . won't come apart. Similarly, Continental "18" floor finish . . . made only with best carnauba wax . . . last longer because *specially processed to adhere to the floor.*

Ordinary floor waxes loaded with resins and other substitutes usually fail because: 1. the solids disintegrate and soon wear *out:* 2. they cling to the feet (instead of the floor) and soon wear *off*. Continental "18", made from indestructible carnauba wax uniquely processed to adhere to the floor, will not wear out . . . takes a long time to wear off! Want proof? Send for experimental sample.

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1632 East National Avenue, Brazil, Ind.

Makers of Car-Na-Var, Car-Na-Lac, Car-Na-Seal and Other Floor Treatments for Large Floor Areas

Eisenman, Secretary and Managing Director, 7301 Euclid Ave., Cleveland 3.

13–15, American Management Association, Personnel Conference, Palmer House, Chicago. James O. Rice, Assistant Secretary and Editor, 330 West 42nd St., New York 18.

20–22, American Institute of Mining Engineers and American Society of Mechanical Engineers, Joint Fuels Conference, Hotel Pennsylvania, New York. Harry Maloney, Assistant Treasurer, 29 West 39th St., New York.

25–Mar. 1, American Society for Testing Materials, Spring Meeting, Hotel William Penn, Pittsburgh. Robert J. Painter, Assistant to Secretary, 260 South Broad St., Philadelphia.

25–March. 2, Twentieth Exposition of Chemical Industries, Grand Central Palace, New York. Charles F. Roth, Manager, 480 Lexington Ave., New York.

MARCH

20–22, Chicago Technical Societies Council, Production Show and 4th Annual Conference, Stevens Hotel, Chicago. Paul A. Jenkins, Executive Secretary, 53 West Jackson Blvd., Chicago 4.

APRIL

1–3, American Society of Mechanical Engineers, Spring Meeting, Hotel Patten, Chattanooga, Tenn. Ernest Hartford, Executive Assistant Secretary, 29 West 39th St., New York.

3–5, Midwest Power Conference, Annual Meeting, Palmer House, Chicago. Stanton E. Winston, Conference Director, Illinois Institute of Technology, 3300 Federal St., Chicago 16.

5–6, American Society of Lubrication Engineers, National Convention, Stevens Hotel, Chicago. B. H. Jennings, Secretary-Treasurer, Northwestern Technological Institute, Evanston, Ill.

7–12, American Society of Tool Engineers, Annual Meeting and Machine Tool Show, Cleveland. Harry E. Conrad, Executive Secretary, 1666 Penobscot Bldg., Detroit 26.

8–11, National Electrical Manufacturers Association, Spring Meeting, Palmer House, Chicago. R. J. Blais, Convention Manager, 155 East 44th St., New York.

8–12, American Chemical Society, Spring Meeting, Atlantic City. Alden H. Emery, Secretary, 1155 Sixteenth St., N. W., Washington, D. C.

9–12, Safety Engineers, 16th Annual Safety Conference and Exposition, Hotel Pennsylvania, New York. Paul F. Stricker, Executive Vice-President, Greater New York Safety Council, Inc., 60 East 42nd St., New York 17.

25–30, International Lighting Exposition, Exposition and Conference, Stevens Hotel, Chicago. E. H. Huercamp, Chairman, 111 West Jackson Blvd., Chicago.

26–27, Society for the Advancement of Management, Time Study and Methods Conference, Hotel Pennsylvania, New York. Carl Coler, Executive Director, 29 West 39th St., New York 18.

30–May 2, Chamber of Commerce of the United States, Annual Meeting, Convention Hall, Atlantic City. Ralph Bradford, General Manager, 1615 H St., N. W., Washington, D. C.